# Electrical World

NOVEMBER 23, 1946

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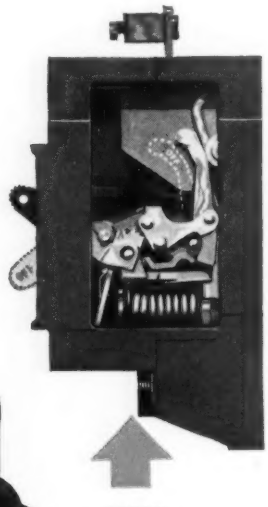

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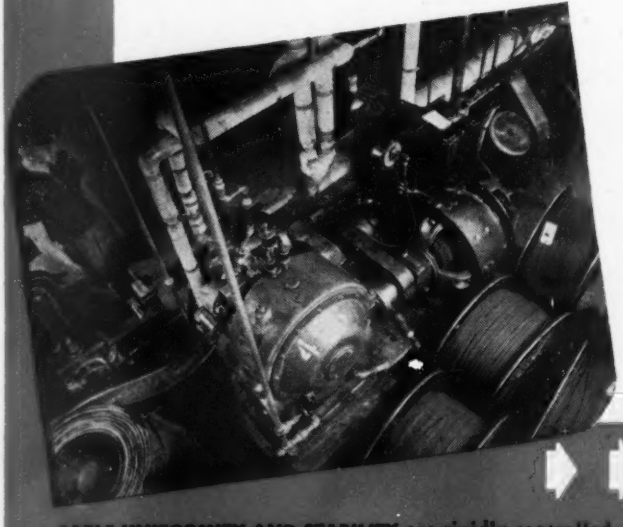

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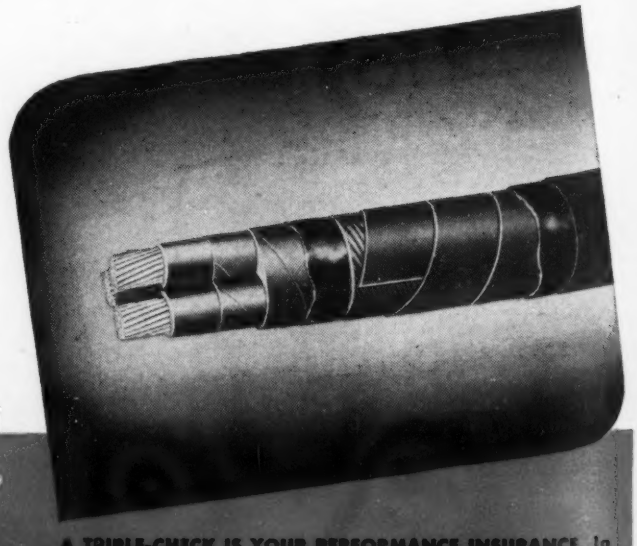

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1753

Electrical World

NOVEMBER 23, 1946

# Right About Face

FROM EVERY QUARTER comes word of loads that are growing beyond all expectation or even explanation. Phrases heard are, "what will we do if we don't get transformers," "where is it all coming from," "wish the management would set the next turbine in motion." Those are typical remarks and they disclose a queer conflict of emotions and motivations among utility personnel, top to bottom. Because they are accompanied by an apathy and a reluctance and a dim, undefined fear that are antithetical to all the signs.

The British had to "shed" load on September 18 because the demand was in excess of available capacity. It was for a brief forenoon period. It came atop a reduction in frequency from 50 to 48 cycles. They, too, had relished a "never too little nor too late" compliment during the war but now they are experiencing a capacity overtaxing demand. The point is that the growing load symptoms may be international in scope.

It is more than barely possible that the public has just begun to go electric. Maybe it has taken a couple of decades of promotional effort to plant and nurse the seed and it is only now ready to bloom. Certainly the present promotional effort is not at one of its peaks of activity —there is too much of the attitude of "We have plenty of load, why push for more?"

Nor does it appear that the increased demand and increased usage are flashes in the pan that can be attributed to a sort of post-war debauch. The phenomenon has the earmarks of a surge and a crescendo rather than a spillover of released enthusiasm.

Granting all this intepretation, can the distribution engineers be justified in taking a negative attitude that approaches the obstructive?

Why shudder every time an air conditioner or a heat pump or a clothes drier or a welder is mentioned? True, they all precipitate conditions that will tax the ingenuity, the economic sense and the vision of the distribution engineer. They *will* do so because they *will* appear in growing numbers on the systems—willy-nilly and whether anybody wants them or not. One utility expects 40,000 electric clothes driers (each 4 to 5 kw.) on its system within five years and that is one for every 20 customers. Room coolers to the tune of three and even five per customer have already been encountered.

It's about time the distribution engineers ceased "viewing with alarm" the loads that are assuredly imminent. It's about time they execute a right-about-face and start thinking of the distribution systems they should be aiming toward if they expect to be able to render the services likely to be expected by the users. They had better prepare their long-range budgets so that managements can do intelligent worrying about the money, the facilities and the returns. Otherwise the distribution engineer will forever be improvising and expanding with reluctance and restraint. If he does the right-about-face in attitude immediately he may someday be able to point with pride to his contribution.

# WATER HEATER Diversity

**Study of available record data reduced to comparable terms shows that diversified demands for uncontrolled heaters of different element sizes fall within narrow range as number in group approaches 1,000**

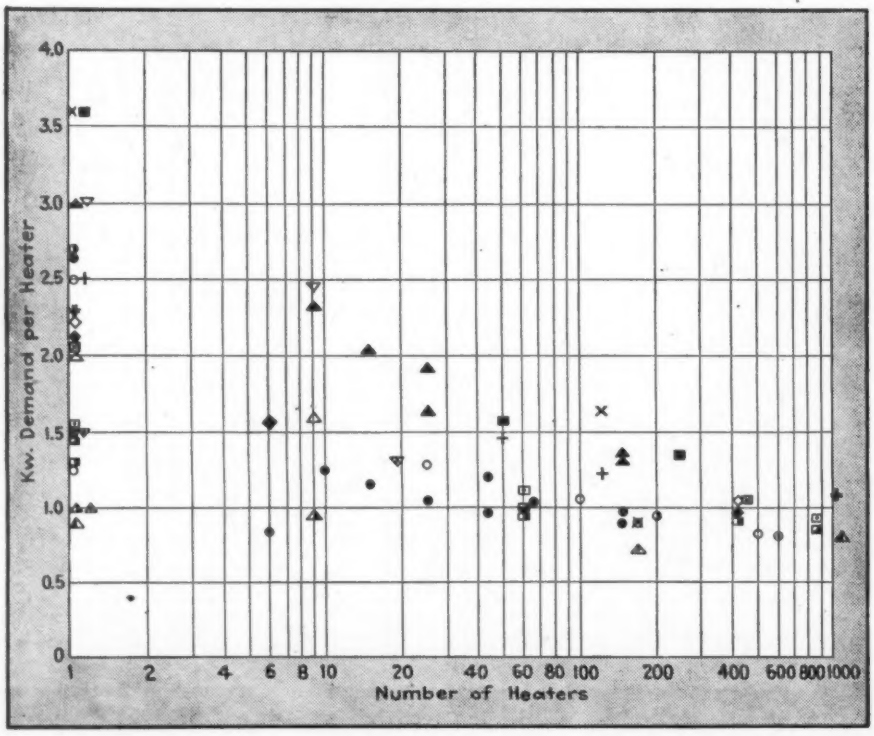
HENRY G. KNAF, *Consulting Engineer, New York, N. Y.*

SINCE the investigations made by the Water Heating Committee of NELA and published in 1931, little additional information on water heater diversity has become available. It seemed that an effort would be justified to coordinate the numerous available tests involving all kinds of element ratings and combinations and to develop a general diversity pattern by putting the different applications on a uniform basis and bringing them into relation with each other; or, when a general pattern cannot be developed because of limitations of available data—as is the case with controlled operation—at least to put the different applications on a uniform basis in order to make them comparable.

On examining the results of a number of water heater tests it became immediately apparent that a coordination of the various demands for different groups of heaters is not possible, because the several daily load curves represent different amounts of energy running from 7.5 to 17.5 kw.-hr. Not until these curves are adjusted to a common kw.-hr. value can the maximum demands be compared and coordinated.

How can the daily load curves be adjusted to a common energy value?

**FIG. 1—Diversified maximum demands for 22 different heaters in uncontrolled operation. Data were taken from 40 available load curves and adjusted to 14 kw.-hr. maximum-day use**




In the above-mentioned report of the NELA Water Heating Committee a significant statement is made in connection with the curves of water draw-offs, which are shown in percentage form. It is said there that, while the actual amount of water drawn varied considerably between different localities, the way in which water was used when a large number of customers were concerned did not vary greatly.

### *Adjustment to Common Basis*

This statement suggests the possibility of a proportional adjustment of the various daily water heater load curves to a common daily kw.-hr. amount. Such an adjustment, of course, can only give approximate results, but with a fairly large number of available tests, a certain cancellation of error can be expected, particularly when the representative kw.-hr. value chosen falls between the high and low limits.

The choice of a representative daily energy use requires some consideration. The last breakdown of average residential kw.-hr. use made by E.E.I. in 1942 arrives at an average of 3,500 kw.-hr. per year for water heaters in normal use. This figure includes all types of water heaters, manual control as well as automatic, insulated as well as uninsulated, with and without furnace coils. On this basis an amount of 3,600 kw.-hr. seems conservative for automatic operation without furnace coils. The figure can be said to represent the use of an average size family of medium circumstances living in a zone of medium climate and doing most of its laundering at home. The corresponding average daily use is 10 kw.-hr.

From a number of investigations it has been established that water heater use exhibits a seasonal variation of about plus and minus 10 percent from normal for the winter and summer season. The drop in summer use can be explained by two factors: higher intake water temperature, which more than cancels the larger hot water use in summer, and sum-

# And Daily Load Curves

mer vacations. With a 10 percent deviation from normal, average summer-day use becomes 9 and average winter-day use 11 kw.-hr. for an annual use of 3,600 kw.-hr.

There also have been observed regional differences, resulting from differences of intake water temperatures. Information on this point, however, is less definite than on seasonal variation. Such regional variations will be ignored here.

### *Maximum-Day Use*

The tests indicate that there are maximum days which considerably exceed average day use. This is due to washday, which quite often falls on Monday. It is hoped that the more widespread use of the automatic laundry, with washing done any day there is an accumulation of dirty laundry, will lead to a levelling of the maximum-day use in spite of the generally expected boost in overall hot water use. For the time being, however, we still should figure on a maximum-day use considerably in excess of the average day use.

From a study of various tests it seemed reasonable to set maximum-day use for the winter at 14 kw.-hr. for 100 units. This would correspond to a water draw-off of less than 60 gal., which is considerably below the 75 gal. usually assumed to be the maximum-day water use. However, it cannot be expected that washday for 100 customers would fall on the same day, nor that all of them would use 75 gal. Thus the above value of 14 kw.-hr. already represents a certain diversification of maximum-day use. This, of course, still leaves the possibility that individual units may reach a maximum use of 19 kw.-hr. corresponding to a maximum-day hot water usage of 75 gal.

The more than 40 available daily load curves for uncontrolled operation were adjusted on the basis of 14 kw.-hr. and the resulting maximum demands plotted in Fig. 1. The heaters include a wide variety of tank sizes, element ratings and combina-

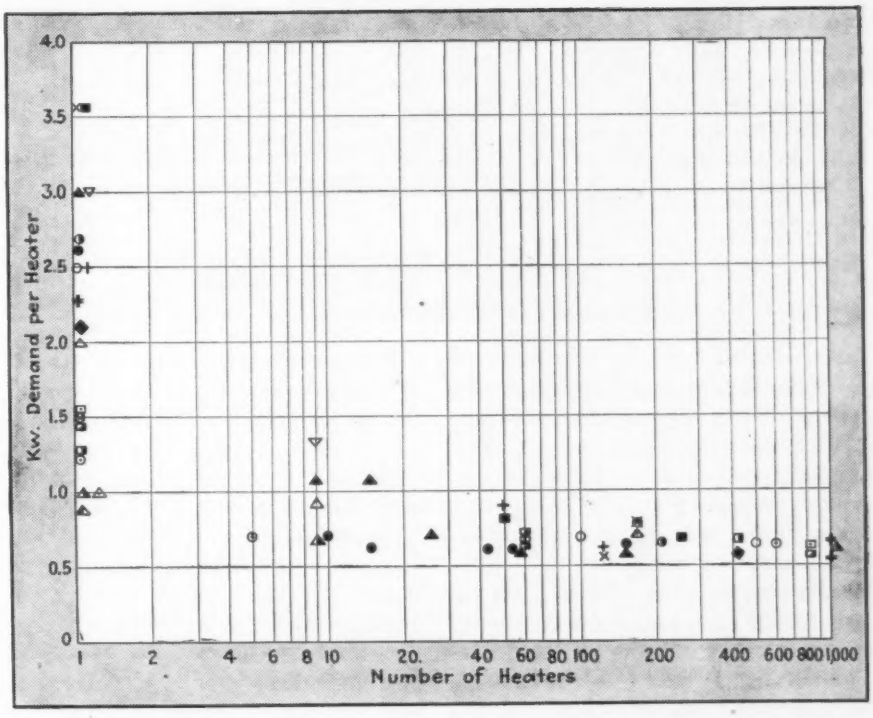



**FIG. 2—Diversified maximum demands at 6 p.m. for 19 different heaters in uncontrolled operation. Data adjusted to 14 kw.-hr. maximum-day use**

**Symbols to Identify Uncontrolled Water Heaters of Figs. 1 & 2**

| SYMBOL | NUMBER OF ELEMENTS | ELEMENT RATING IN KW. | RELATION BETWEEN ELEMENTS | TANK GALLONS | DEMAND MINUTES |
|---|---|---|---|---|---|
| × | 1 | 3.6 | ..... | 24 | .... |
| ■ | 1 | 3.58 | ..... | 32 | 15 |
| ▲▽ | 1 | 3.0 | ..... | 30 | 15 |
| ◑ | 2 | 2.7 (1.84–0.86) | not interlocked | 50 | 30 |
| ● | 2 | 2.64 (1.76–0.87) | not interlocked | 43 | 60 |
| ○ | 2 | 2.5 (1.65–0.85) | not interlocked | 40 | 15 |
| + | 2 | 2.5 (larger elem) | interlocked | .... | 30 |
| ✱ | 2 | 2.27 (larger elem) | interlocked | .... | 30 |
| ◇ | 2 | 2.25 (1.5–0.75) | not interlocked | 30 | 15 |
| ◆ | 2 | 2.1 (1.5–0.6) | not interlocked | 30 | 15 |
| ⊠ | 1 | 2.0 | ..... | .... | 30 |
| △ | 2 | 2.0–2.0 | interlocked | 30 | 15 |
| ⊡ | 2 | 1.50 (1.0–0.5) | not interlocked | 36 | 15 |
| ⊠ | 1 | 1.5 | ..... | 30 | 15 |
| ▽ | 2 | 1.5–1.5 | interlocked | 30 | 15 |
| ◪ | 2 | 1.50 (1.0–0.5) | not interlocked | 50 | 15 |
| ◧ | 1 | 1.27 | ..... | 40 | 15 |
| ⊙ | 2 | 1.25–0.6 | interlocked | 40 | 15 |
| ▲ | 2 | 1.0 –1.0 | interlocked | 30 | 15 |
| ◬ | 2 | 1.0 –0.6 | interlocked | 30 | 15 |
| ▲ | 2 | .9 –0.9 | interlocked | 30 | 15 |

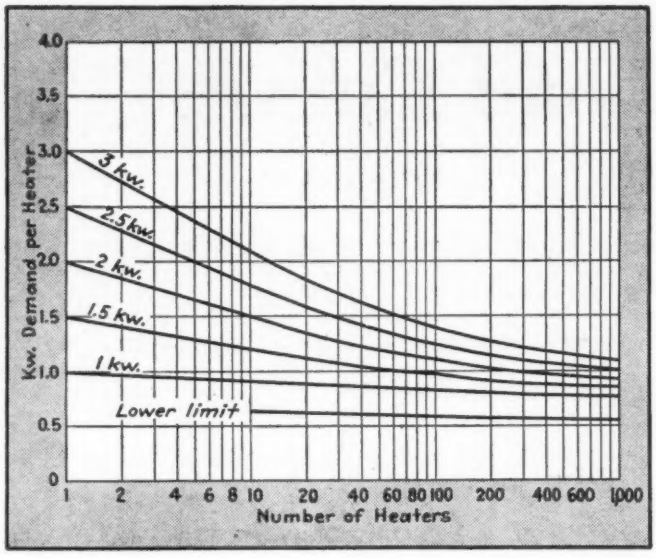



**FIG. 3—Diversified maximum demands for 5 single-element heaters, uncontrolled. Maximum-day use: 15.5 kw.-hr. for 10 units, 14 kw.-hr. for 100 units, 12.5 kw.-hr. for 1,000 units**

tions, identified in the tabulation of symbols. In this connection, it should be noted that several of the heaters are for controlled operation, but since the restricted period was in the late afternoon, their morning peaks could be used for uncontrolled operation. The demands in the majority of cases are for a period of 15 min., several are for 30 min. and a few for 1 hr.

The number of units for the different tests runs from 5 to over 1,000. It should be mentioned that, with the exception of one test which measures the demand of 1,400 heaters at a substation, the largest number of individual heaters involved in any test are 60 heaters for the tests made by the NELA Water Heating Committee, three of which are included in the plotting. All other tests are for a smaller number of units. The demands for groups of 100 heaters and more are based on heater days. For instance a group of 20 heaters running five weekdays represents 100 heater days.

There is understandable reluctance to believe that 20 heaters running five weekdays will, when averaged, produce the same daily load curve and maximum demand as 100 heaters running one day. But when it is realized that in both cases the daily energy use is adjusted to 14 kw.-hr.—that is, the area under the curve is the same—the possibility of a large difference in the resulting maximum demand seems lessened.

The ratings of the various heaters, whose maximum demands are plotted on Fig. 1, range from 3,600 to 900 watts. It goes without saying that for individual heaters the ratings represent the maximum demands. In the case of two-element heaters the heater rating is considered equal to the sum of the two elements when the two elements are not interlocked and equal to the rating of the larger element when they are interlocked.

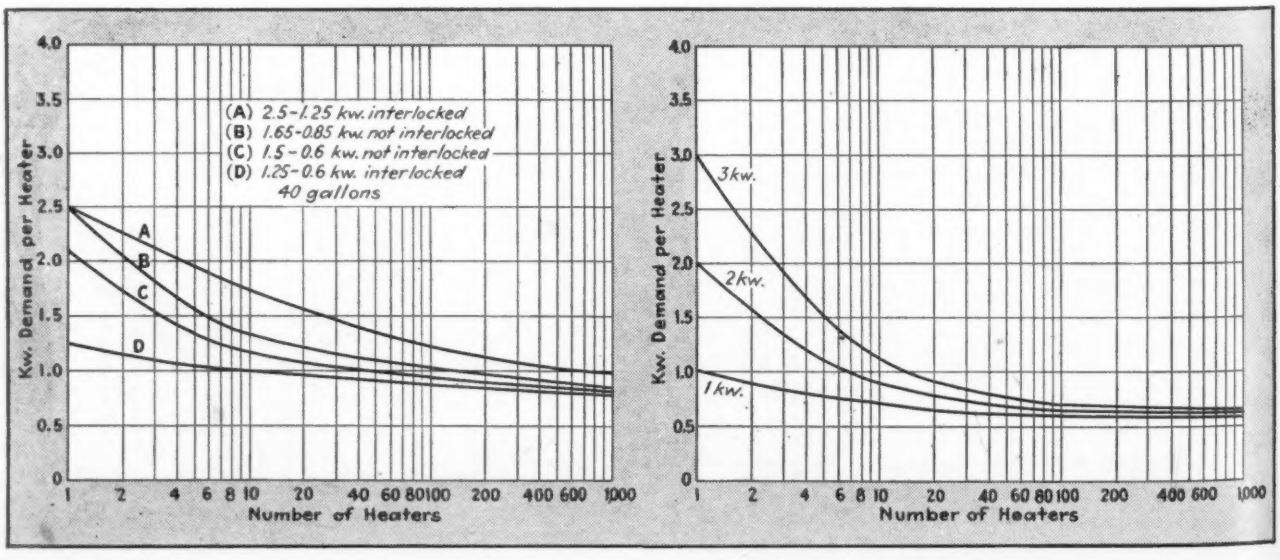
The diversity pattern reveals the following interesting feature: The diversified maximum demands of the various types of uncontrolled heaters rated between 900 and 3,600 watts tend to approach each other within a fairly close range by the time the number of heaters has reached 1,000. That means that the maximum demands of the higher ratings drop at a faster rate than those of the lower ones. Or to use the words of H. A. Snow* 16 years ago: "It makes only a little difference at the power house whether high-wattage or low-wattage heaters are used."

Fig. 1, which shows the daily maximum demands, is supplemented by another chart in which is plotted the heater demands at 6 p.m., the time of the residential peak, when range saturation exceeds 3 percent (Fig. 2). It can be observed that the demands, particularly for 100 heaters and more, fall within a rather narrow band and that the demands of some of the

* "Water Heating As a Load" by H. A. Snow, ELECTRICAL WORLD, January 11, 1930.

**FIG. 4—Diversified maximum demands for four 2-element heaters, uncontrolled. Maximum-day use: 15.5 kw.-hr. for 10 units, 14 kw.-hr. for 100 units, 12.5 kw.-hr. for 1,000 units**

**FIG. 5—Diversified 6 p.m. demands for 3 single-element heaters, uncontrolled. Maximum-day use: 15.5 kw.-hr. for 10 units, 14 kw.-hr. for 100 units, 12.5 kw.-hr. for 1,000 units**



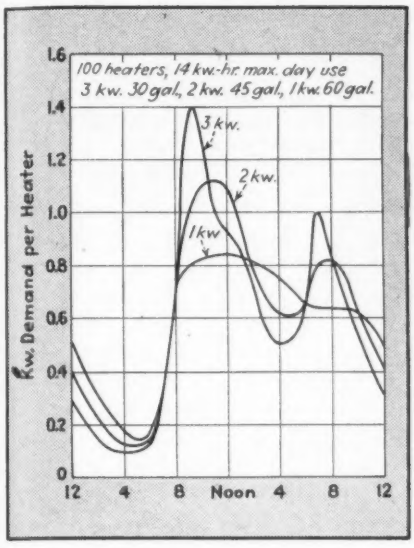



**FIG. 6—Daily load curves for 3 single-element heaters, uncontrolled**

higher ratings tend to fall below those with lower ratings.

On the basis of the maximum demands of Fig. 1, a group of five diversity curves was developed, and plotted in Fig. 3. They are for single-element heaters with ratings of 1, 1.5, 2, 2.5, and 3 kw., and with corresponding tanks of 60, 50, 45, 40, and 30 gal.

In order to incorporate the changes which must be expected due to diversity in maximum-day kw.-hr. use as the number of heaters increases from 10 to 1,000, the 14-kw.-hr. maximum-day use for 100 is raised to 15.5 kw.-hr. for 10, and decreased to 12.5 kw.-hr. for 1,000 units.

Obviously the five types of heaters shown could not give identical water service, that is the same water temperatures with the same water draw-offs even with variation in the temperature settings of the elements. In fact the 1-kw. single-element heater would hardly be practical. Nor would their losses be the same. However, these curves may serve as a general reference frame for the diversified demands of different element ratings.

The curve at the bottom represents the theoretical lower limits of the maximum demands. With the basic assumptions of 15.5 kw.-hr. for 10 units, of 14 kw.-hr. for 100 units, and of 12.5 kw.-hr. for 1,000 units, the lowest possible maximum demands (or ratings) with continuous operation and a diversity of one are 650, 580, and 520 watts.

In Fig. 4, diversity curves for the following four types of two-element heaters are shown: (a) (2.5-1.25) kw. interlocked; (b) (1.65-0.85) kw. not interlocked; (c) (1.5-0.6) kw. not interlocked; and (d) (1.25-0.6) kw. interlocked. The two heaters whose elements are not interlocked are rated at the sum of the two elements, namely 2.5 and 2.1 kw., while the heaters whose elements are interlocked are rated at the capacities of the larger elements.

The foregoing diversity curves are for maximum demands. Curves for 6 p.m. demands are drawn on Fig. 5. Only three curves, those for 3-kw., 2-kw. and 1-kw. single-element units are shown. The narrowness of the band beyond 100 units indicates that for practical purposes the 6 p.m. demands for the different element ratings can be considered identical. This holds true also for the various types of two-element heaters.

### *Load Curves of Uncontrolled Heaters*

In Fig. 6, illustrative daily load curves for a 3-kw., 2-kw., and 1-kw., single-element heater are shown. They are for groups of 100 units and a maximum-day use of 14 kw.-hr. and represent 15-min. demands. Their shapes were developed from a number of daily load curves.

The morning peaks and the 6 p.m. demands conform to the values in Figs. 3 and 5. Morning as well as evening peaks show the well-known tendency to occur progressively later as the heater rating decreases. The afternoon dip becomes more pronounced as the rating increases. In the early morning hours between 5 and 6 a.m., a low point is reached where the heater elements operate only to furnish energy to make up for standby losses.

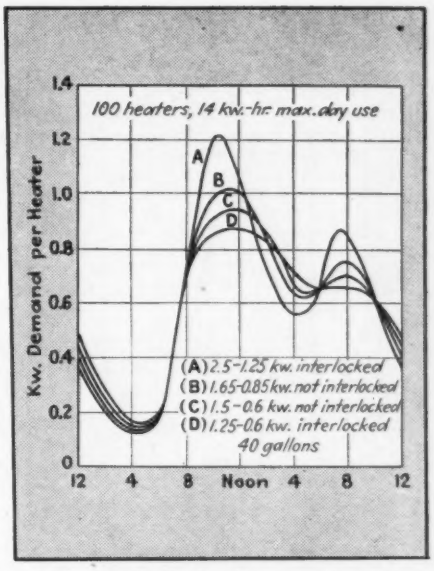



**FIG. 7—Daily load curves for four 2-element heaters, uncontrolled**

Four illustrative daily load curves for two-element heaters are shown in Fig. 7. They are for the same heaters as on Fig. 4 and are also for groups of 100 units. In two cases the elements are interlocked, in the other two they are not.

### *Diversity of Controlled Heaters*

Controlled operation as discussed here is confined to cases of time clock control. Carrier control offers such an unlimited scope for placing of and experimentation with off-peak periods that a discussion of diversified demands in connection with this type of control seems unnecessary.

In the case of time clock control a number of tests were available which

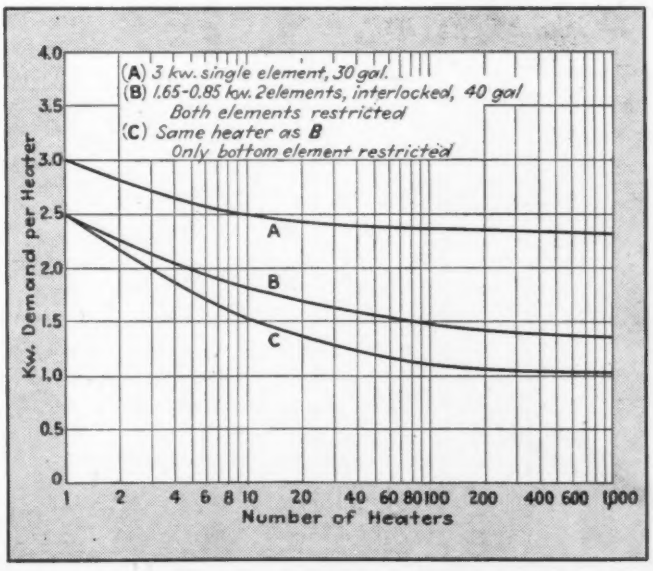



**FIG. 8—Diversified maximum demands for 3 controlled heaters, 4 hours off. Maximum - day use: 15.5 kw.-hr. for 10 units, 14 kw.-hr. for 100 units, 12.5 kw.-hr. for 1,000 units**

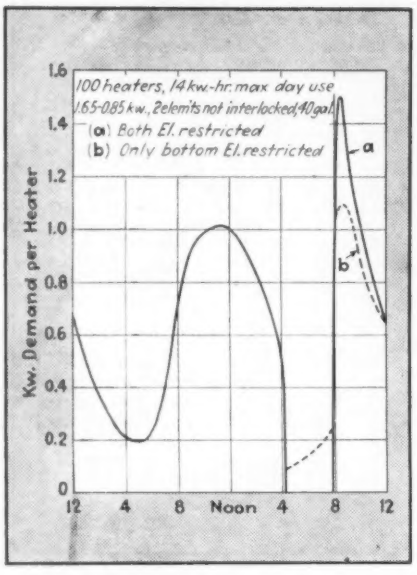



**FIG. 9—Daily load curve for controlled heater, 4 hours off**

served as a basis for the study of the behavior of water heater demands for controlled operation. The presentation, however, confines itself to several individual applications because the number of tests is not sufficient to develop a general pattern similar to the one for uncontrolled operation. To make them comparable these applications have been put on a uniform basis, that is they have been adjusted to a maximum-day use of 14 kw.-hr. for 100 units.

From the examination of test results it became apparent that single-element heaters generally show little decrease in diversified demands when the restricted period is 6 hr. or more, that is, all heaters would be on the line when operation is resumed.

Two-element heaters show some diversification of maximum demands at the resumption of operation even after a restricted period of 6 hr. or more, particularly when the top or booster element remains uncontrolled during the off-period.

With restricted periods of 4 hr., considerable diversification of maximum demands takes place. Examples of diversity under such conditions are shown in Fig. 8. They include the following heaters: (a) a 30-gal., 3-kw. single-element unit; (b) a 40-gal., 2.5-kw. (1.65 and 0.85) two element heater with both elements controlled and (c) the same heater with only the bottom element controlled. It should be noted that maximum-day use has been increased from 14 kw.-hr. for 100 units to 15.5 kw.-hr. for 10 units and decreased to 12.5 kw.-hr. for 1,000 units.

These are the only cases where diversity curves could be developed. In all other instances the maximum demands for 100 units, as shown in the daily load curves of Figs. 9, 10, 11 and 12, can for practical purposes be considered as the completely diversified demands.

### *Load Curves of Controlled Heaters*

Figs. 9, 10, 11, and 12 are illustrative daily load graphs showing 15-min. demands for various types of heaters, all with two elements in restricted operation. Curves "a" are for both elements restricted and "b" for only the bottom element cut off. All four graphs are for 100 units and are adjusted to 14 kw.-hr. The first two are for 40-gal. heaters with a restricted period of 4 hr. The heater in Fig. 9 has a top element of 1.65 kw. and a bottom element of 0.85 kw. They are not interlocked. Fig. 10 shows a heater with element ratings of 1.25 and 0.6 kw. In this case the elements are interlocked.

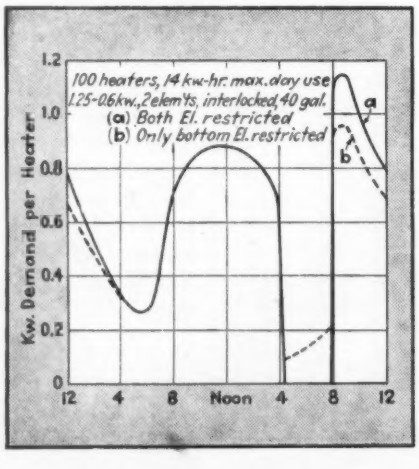
Fig. 11 has a restricted period of 8 hr. The heater (50 gal.) has a 1.5-kw. top and a 0.75-kw. bottom element, not interlocked.

Fig. 12 is for a restricted period of 14 hr. The 66-gal. heater has a top element of 2.0 kw. and a bottom element of 1.25 kw. interlocked.

Allowance has been made for a certain staggering of the clock settings so that the heaters would not come back simultaneously but within a period of 30 min. or more. Obviously by purposely extending the staggering of clock settings over a longer period some reduction of the peaks at the resumption of operation after the restricted period can be achieved.

The coordination on a unified basis of a fairly large number of water heater tests including a wide range of element ratings has resulted in the establishment of a general diversity pattern for uncontrolled operation. The main feature of this pattern is that the maximum demands for heaters with higher element ratings tend to approach those of lower rating as the number of heaters increases.

**FIG. 10—Daily load curve for controlled heater, 4 hours off**



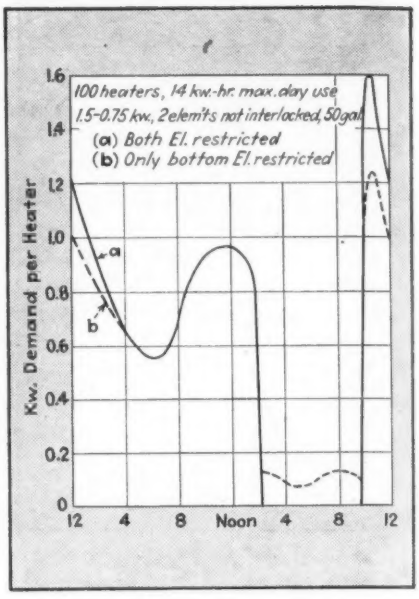
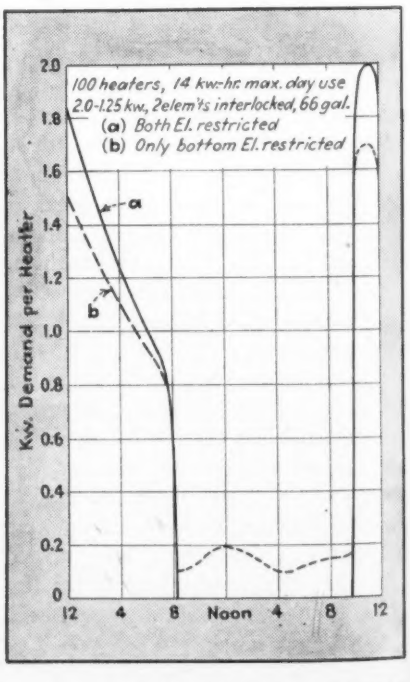




**FIG. 11—Daily load curve for controlled heater, 8 hours off**

**FIG. 12—Daily load curve for controlled heater, 14 hours off**



# Adjustable Cable Puller Saves $280 per Day

E. W. TEMPLIN and I. L. BATEMAN*, Los Angeles Dept. of Water & Power

**Cable puller unit consists of converted Sterling truck frame and motor, Braden winch worm gear and shaft drive and cable reel mounted on six-wheel trailer**

STEADY PULLING POWER up to a maximum of 30,000 lb., variable pulling speed, greater maneuverability and large savings in pulling costs are features of a specially designed cable puller recently placed in service by the Los Angeles Department of Water & Power. The new equipment illustrated displaces cable-pulling trucks provided with a gasoline-engine-powered winch and a power-driven nigger head that have been in use since 1918. In this older equipment, the winch was used to break the cable free from its resting place in the duct line and to pull the end to the surface, after which the nigger head was used to reel up the cable. This system was slow and jerky but was a great improvement over a 500-volt motor-driven winch dating back to 1912. From 1905 to 1912, cable had been pulled by hand-operated winches.

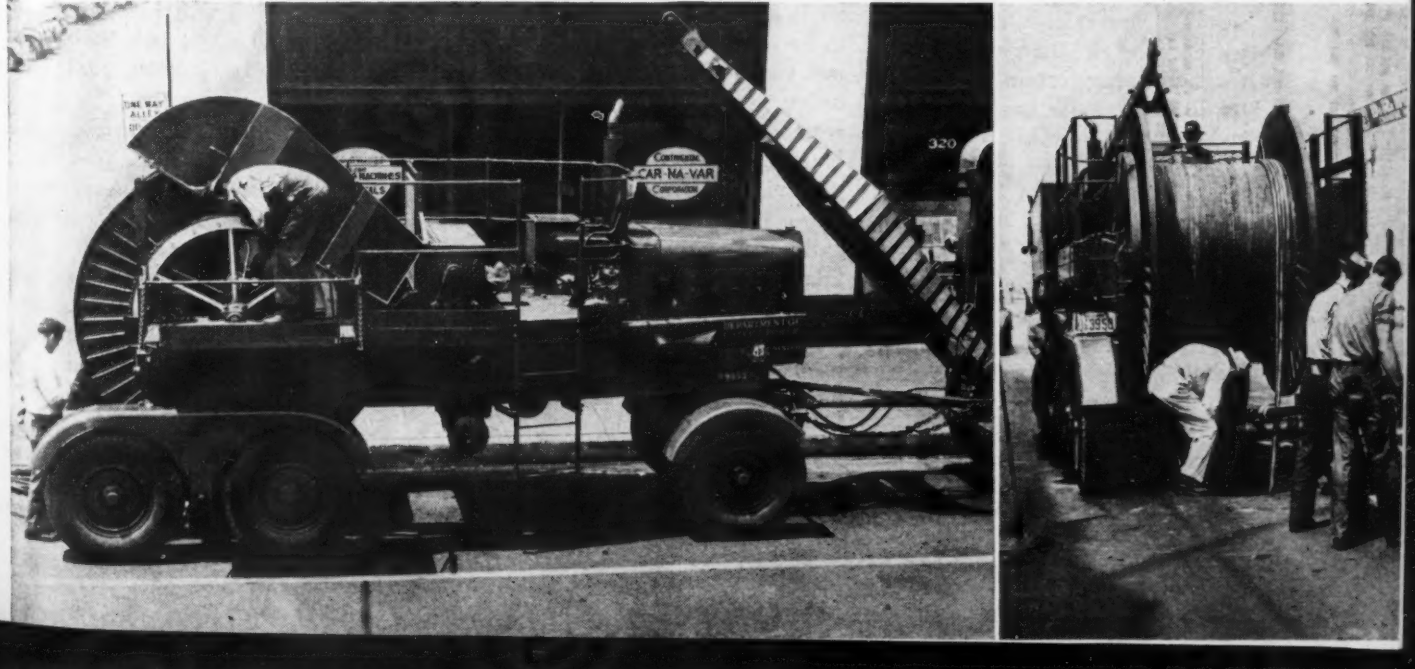
The new equipment, designed and built by the Department, is a trailer-mounted six-wheel gasoline-engine-driven underground cable-pulling vehicle, provided with a single steel pulling reel. The reel will hold more than 800 ft. of 138-kv. single conductor, 1,500,000 cir. mil oil-filled lead-covered cable with an outside diameter of $3\frac{3}{8}$ in., which is the largest cable in use by the city. Pulling speed can be varied from 3 ft. per minute, which permits ample time for inspection, to 40 ft. per minute. The steel cable-reel, as shown, is equipped with two oil-filled reservoirs which can be attached to 34.5- and 138-kv. oil-filled cables that are being removed or installed, thereby keeping the cables under oil pressure and free of air and moisture during pulling operations. On one side of the reel there is a trough leading into the inside through which the end of an oil-filled cable can be anchored and equipped with oil piping to the oil reservoirs. The pulling reel, 5 ft. in diameter, 4 ft. wide with flanges 8 ft. in diameter, was designed to revolve on double row self-aligning roller bearings mounted on a $3\frac{1}{2}$-in. stationary shaft. The reel is constructed of $\frac{3}{8}$-in. steel plate reinforced with steel spokes to resist the crushing stress of the tightly wound cable.

The pulling reel is power driven by a Sterling truck engine and gearing, together with a Braden winch worm gear and shaft mounted on the trailer forward of the reel. The original truck frame was cut at two places, in line with the rear end of the main transmission shaft and in line with the forward end of the auxiliary transmission shaft. The middle section was removed and the truck frame welded together, with six plate legs for bolting to the trailer frame. The drive shaft was removed and replaced by a "fast" flexible coupling, thus shortening up the engine and transmission into a compact unit only 10 ft. in length.

The engine is a Waukesha 6-125 of 462-cu.in. displacement with a maximum torque of 324 ft.-lb. at 1,000 rpm. The desired speed of the cable was 3 fpm. or one revolution of the

*Automotive engineer, and engineer of transmission, distribution and communication, respectively.

**TRAILER UNIT specially designed for installing and removing cable on Los Angeles City system . . . Roller guide bar (right) is used to wind cable in layers. At 3 ft. per minute a pull of 30,000 lb. can be exerted to break cable free in duct**



bare reel every 5 minutes, which required a total ratio of 5,000 to 1 at 1,000 rpm. of the engine. The main transmission is a Fuller M.R.O. with four speeds forward and one reverse. The end of the two-speed auxiliary transmission shaft was connected by roller chain and sprockets to a standard truck winch worm reduction gear, 34 to 1 ratio having a rated capacity of 25,000 lb. The $2\frac{5}{8}$-in. diameter slow-speed shaft of the worm gear runs across the frame parallel to the reel shaft and is supported at the outer ends by standard winch bearings. The final drive is from the worm gear slow-speed shaft 15-tooth sprocket to a 130-tooth sprocket on the outside of the reel, thus making a total reduction in lowest gear of 4,920 to 1 and the highest gear of 334 to 1 with eight intermediate speeds. The engine frame and reel were mounted on a 34,000-lb. gross capacity 6-wheel trailer with two steering wheels in front, with fifth wheel and drawbar and four wheels in rear mounted on walking beams.

Cable puller is towed by one of the underground service trucks by means of a balanced towbar to the manhole or vault. The operator sits with his back to the engine on a platform built on top of the trailer frame where he faces the power take-up reel and has a good view of all operations. It is estimated that the greatest pull required to break loose the largest cable from its resting place in any duct line on the power system would not exceed 30,000 lb., which the cable puller is easily capable of making momentarily at an engine speed of 1,000 rpm.

Cost of operating the puller with a crew is about $170 per day, which work, if done by the old method, would have required three crews at a total of $450 per day.

# *Is the Load Dispatcher* MANAGEMENT *or* LABOR?

**JESS P. PASCHALL***
Load Dispatcher
Portland General Electric Co.
Portland, Oregon

IF A POWER SYSTEM is to be operated and maintained efficiently, it must have a central responsible operator whose judgment can be relied upon at all times, and especially so during serious system trouble. This man must be capable of making quick and accurate decisions when called upon to do so, and such times usually come without warning. If there could be a set rule to follow each time trouble occurs on the system, it would be an easy matter to cope with the situation, for the operator would soon learn the proper procedure and thereafter he would need only to repeat what he had to do the last time. But it so happens that there can be no set rule to follow and for the very simple reason that hardly any two cases of trouble are alike. Each time trouble occurs on the system the operator must size up the situation quickly and set about ordering certain operations to restore service. He has long since learned that to allow himself to become excited or rattled prolongs restoring service to normal.

By the very nature of his work he is about as close to the company's business as any supervisor could possibly be. At the close of each day, and long before the general office opens, he has compiled certain figures that tell him how much business was done by the company during the previous 24 hours. Then he goes back a year or so and takes a certain figure against which he can compare the previous day and find out whether there has been an increase or decrease in the sale of electric energy. He knows the percentage of steam and hydro generation, how much fuel was consumed and its unit cost as well. He knows something about system losses and load factor and is familiar with power purchase contracts.

Now the question arises—Does this man belong with management? Some companies include him in the union agreement while others consider him either a part of management, or too close to the dividing line to be included in the union agreement. To us, he is doing administrative work and belongs on the management side.

This is said with the most sympathetic feeling for organized labor, having long been associated with it, but when an employee is considered to be a part of management, he cannot very well be made a part of a union agreement and carry out the responsibilities and obligations to both the union and the company. A supervisor must necessarily make certain commitments to the management and possess a certain amount of confidential information that might be extremely difficult to keep on the floor of the union hall. Likewise, he would have obligations to the union and union information that might be troublesome to retain while seated in the general manager's office.

The supervisor is usually more concerned with looking out for the company's interest than the worker is. This is not a criticism of the worker, for the supervisor has been taken into the management's confidence and he is in possession of certain information concerning the business that is not generally known among the rank and file of the workers. He is interested in seeing black figures on the company's ledger, while the worker may or may not be so concerned.

The question of what constitutes a supervisor is sometimes debated. The right to hire and fire is important, but no technical training is required to do this. Being required to use discretion and judgment of undirected choice is, we think, a major factor in determining the status of a supervisor. Company policies and rules guide most supervisors in their jobs but the load dispatcher must rely upon his own judgment in supervising the operation of the electric system. Of course, he is bound by the same company policies that cover other employees but he must, as we have said, resort to whatever is in his opinion the best thing to do to reestablish and maintain the customer's service under constantly changing conditions. Load dispatchers must possess a certain amount of technical training and many years' experience operating stations and substations to qualify for his job. Since all of his orders are given over the telephone he must possess a suitable personality.

* The author also is president of the Northwest Dispatchers Association.

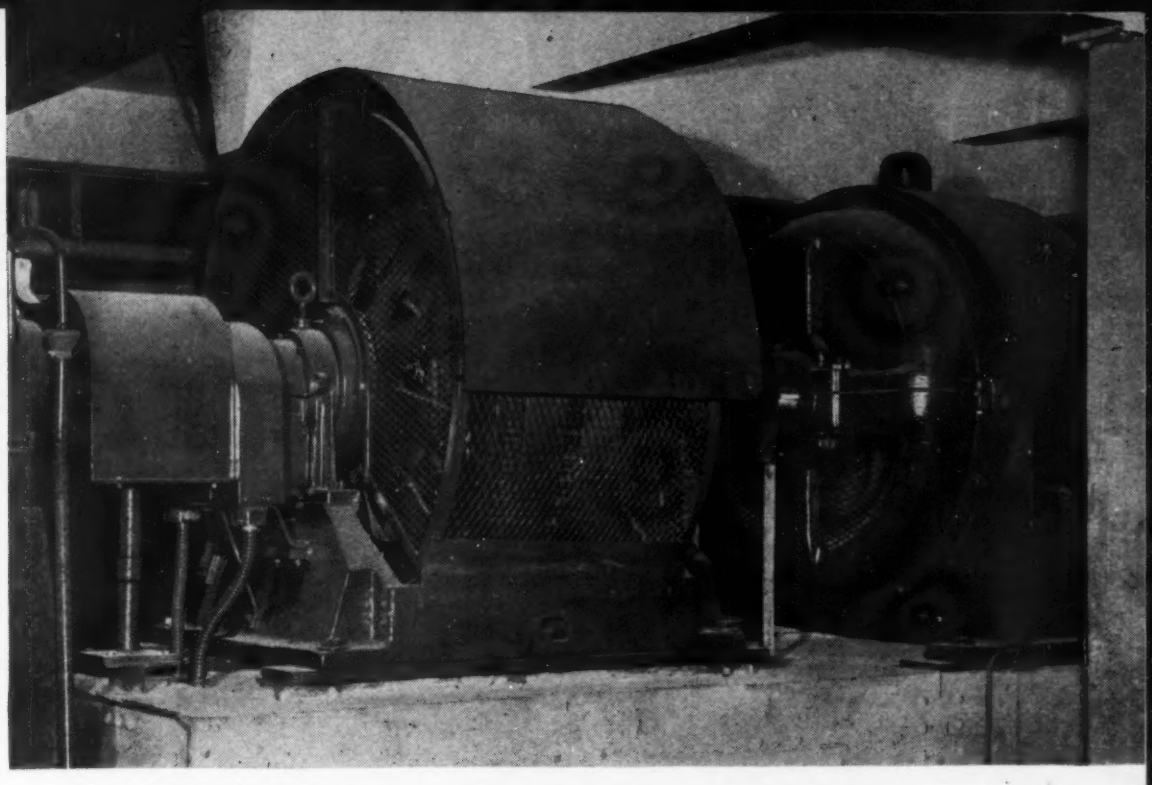


FIG. 1—Dynamatic clutch on induced draft fan drive. Governor-generator and slip rings on the left; Westinghouse 450-hp. motor on right

# Reliable Electronic Controls *for* FAN *and* STOKER DRIVES . . . I

D. L. GREENE, *Elec. Engr., Gilbert Associates, Inc., Reading, Pa. and*

R. L. JAESCHKE, *Elec. Engr., Dynamatic Corp., Kenosha, Wis.*

**Virtually identical electronic controls provided for the induced draft fan clutches and the stoker drives in Jennison Station . . . Three electronic units for two couplings afford automatic changeover in event of tube and excitation failure**

VARIABLE SPEED requirements of the stokers and I.D. fans in the new Jennison Station on the New York State Electric & Gas Corp. system are accomplished with Louis Allis Adjusto-Spede drives for the stokers and Dynamatic Corp. eddy-current clutches for the induced-draft fans. These coupling devices, between the motor and the equipment, consist of a driving member connected to the motor shaft and a driven member connected to the equipment shaft. Coupling between the two members is the magnetic flux induced by the field coils on the driven member, field current being supplied by the electronic excitation cabinets, and governed by the boiler combustion controls.

Electronic control and power supply for the 7½-hp. Adjusto-Spede drives is essentially the same as the 450-hp. magnetic couplings, so that the stoker controls are essentially the same as the following description of the I.D. fan controls. Each I.D. fan electronic excitation cabinet contains two dual service tubes for each function while the stoker cabinets have single tube service, which in addition to relative sizes is the only difference between the two controls.

### *Basic Operation*

Each of the two 200,000-lb./hr. Combustion Engineering Co. boilers have one Sturtevant forced-draft and one induced-draft fan. Power for each fan motor is obtained from separate air circuit breakers in the 2,300-volt metal-clad switchgear. Power for the I.D. fan couplings is taken from the motor circuit through 2,200/220-volt air-cooled transformers and for the stoker drives directly from the 440-volt motor leads.

Three electronic excitation cabinets were supplied for the two fan couplings along with a control cabinet which incorporates three panel-mounted air circuit breakers, transfer relays and miscellaneous controls as shown in Fig. 2. The cabinet power supply, from the I.D. fan motor circuits, was brought to two of these air circuit breakers, the third being for the control of the third or emergency electronic cabinet with power obtained from the station 440-volt tie bus. This breaker, on the 440-volt tie bus, is the supply for both the third or emergency electronic excitation cabinet on both the I.D. fan and stoker controls and is operated from a control switch located near the I.D. fan control cabinet.

Normally each coupling operates from its own electronic cabinet with the spare cabinet energized ready for

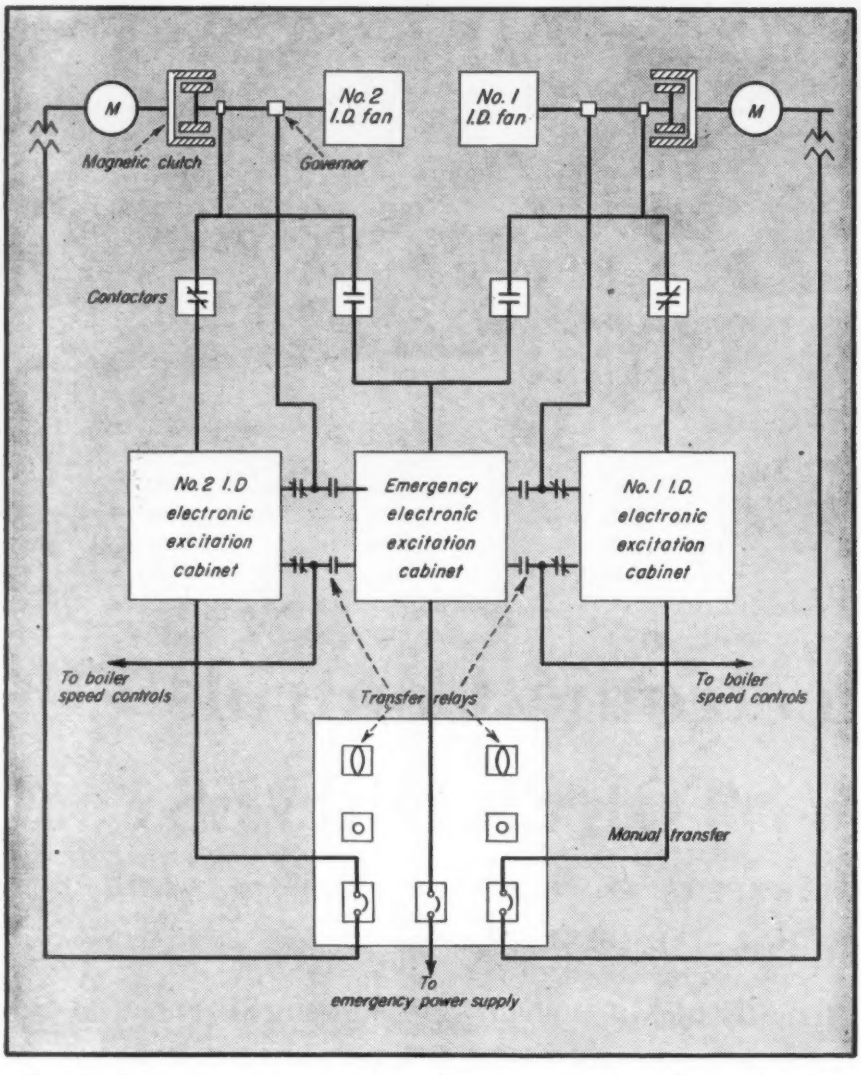
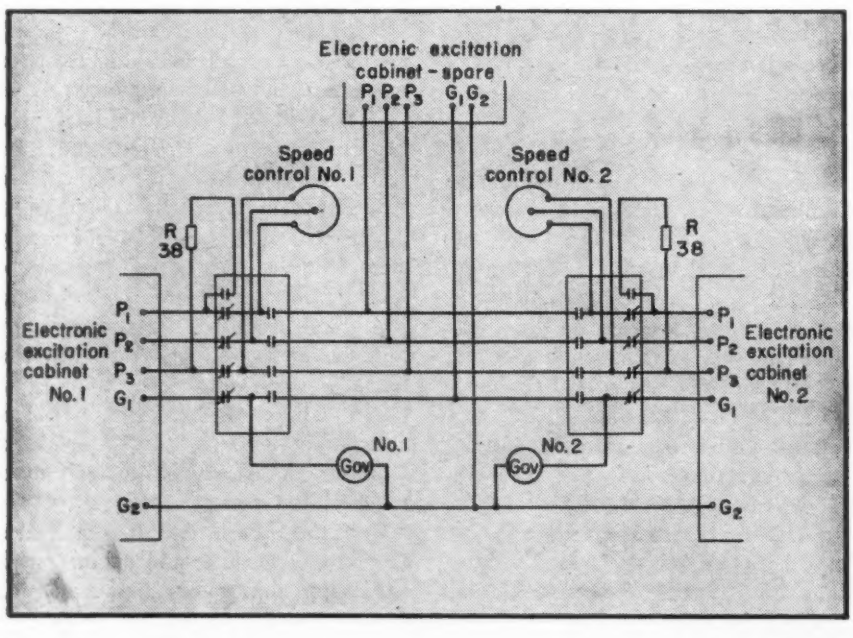



**FIG. 2—Schematic diagram of three electronic excitation cabinets (one for emergency) for two fan drives**

**FIG. 3—Schematic principle throwover arrangement of governor and speed control on eddy-current coupling**




operation. The controls are arranged to transfer either fan control to the emergency cabinet automatically in case of failure, or the transfer may be initiated manually with a push-button on the control cabinet.

The electronic cabinets each have "high" and "low" speed sensitive differential relays that are adjustable by small rheostats. These relays reflect a disagreement between the speed control (voltage reference) circuit, which is positioned by a rheostat operated by the boiler controls, and the governor generator on the fan or driven member of the coupling and reflects the fan speed. The sensitivity or pickup of the relays is regulated by rheostats to prevent their operation on normal load changes, and are adjusted to suit the inherent characteristics of each installation. The transfer of the speed controls and governors is schematically shown in Fig. 3.

### *Unnecessary Transfer Precluded*

The contacts of these differential relays are paralleled and connected to the coil of a "transfer" timer which backs up the setting of the relays in case of unusual conditions and prevents an unnecessary transfer to the emergency cabinet. If, however, a failure of any piece of equipment in the electronic control occurs or the equipment fails to function properly, the differential relays will operate and energize the transfer timer which, after a predetermined time, will close its contacts and operate a multi-contact transfer relay. This transfer relay instantly transfers the complete controls of the coupling to the emergency cabinet and operation continues without a noticeable break. With one coupling operating from the emergency cabinet the second coupling is prevented from transferring and will trip its main I.D. fan breaker. In case of failure of the emergency cabinet, the same timing sequence occurs but in this case the circuit breaker, on the fan operating from this cabinet, is tripped.

Two pushbuttons are supplied on the control cabinet to permit a manual transfer of either control being made to check and make periodic inspections and necessary replacements on the electronic controls.

A signal light and audible alarm is provided on the boiler board for the I.D. fan system and another for

the stoker system to indicate to the boiler operator that a transfer has occurred. D.c. magnetic contactors are used on the main leads to the couplings to handle the current and inductive arcs when breaking this circuit, the control of these relays being through the transfer relay.

### *Electronic Fan Drive*

A functional diagram of the component elements of the variable speed drive is shown in Fig. 2. A standard 585-rpm. induction motor is used to drive the dynamatic clutch. The output speed of the clutch, which is in turn connected to the induced draft fan, is controlled by the quantity of excitation applied to the clutch field coils. The output speed of this shaft is determined by the boiler controls and governor generator through the electronic control system which provides excitation for the clutch. The success of the control mechanism depends mainly on the following circuits:

*Governor Generator*

The characteristics of the governor generator produce a voltage exactly proportional to the speed of the output shaft.

*Electronic Control System*

This system may be manually operated to adjust the speed to any desired value but is entirely automatic and precise in operation for any given setting of the speed control. This speed control is connected to a standard boiler operator.

*Reference Voltage Circuits*

An electrically operated clutch mechanism responds to the resultant voltages from the manual speed control and the voltage from the governor generator.

*Safety Trip Circuit*

This system will initiate the transfer of the electronic control to a spare and waiting control in case of any control element failures.

*Governor Generator*

A small governor generator is connected to the output shaft of the clutch through a gear mechanism. This generator has a voltage which is a linear function of the rotating speed of the output shaft, with its frequency varying with the voltage. The governor generator is of the permanent magnet type generating alternating current in order to dispense with slip rings or commutators. Commutation in the past has proved objectionable because of brush wear and electrical leaks to ground; therefore, the maintenance problems in the a.c. generator are less and provide greater economy and reliability. In practice it is found the lowest frequency of the generator is about 60 cycles and the highest, at top speed, approximately 4,000 cycles.

Fig. 5 shows the voltage generated at different speeds on the Jennison installation. Rectification of the a.c. generator voltage is necessary since the grid control scheme requires d.c. voltage for good stable operation. A small step-up transformer, approximately 3 to 1, with a full wave rectifier connected to the transformer and an appropriate filter system is used for this purpose.

Details of the above components and of the automatic transfer will be treated in an ensuing instalment.

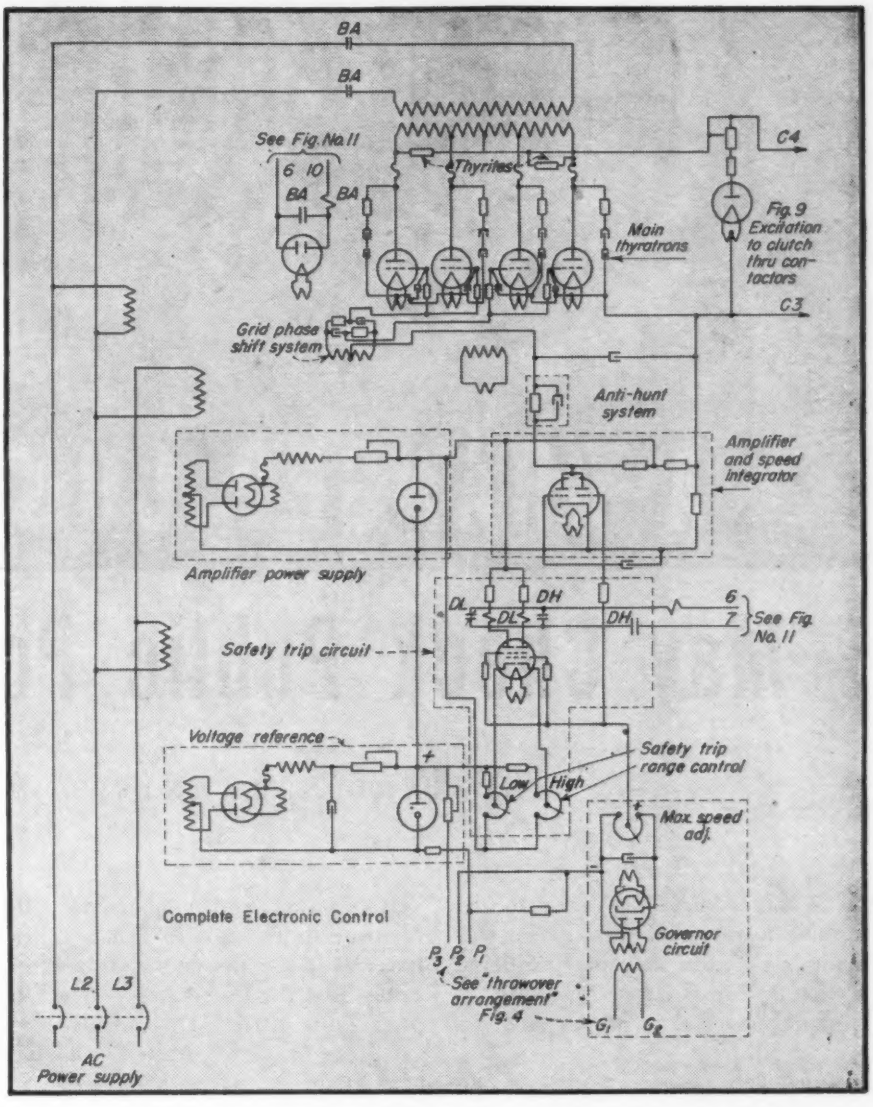
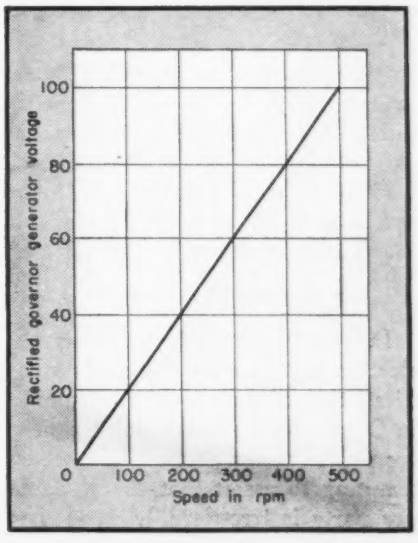
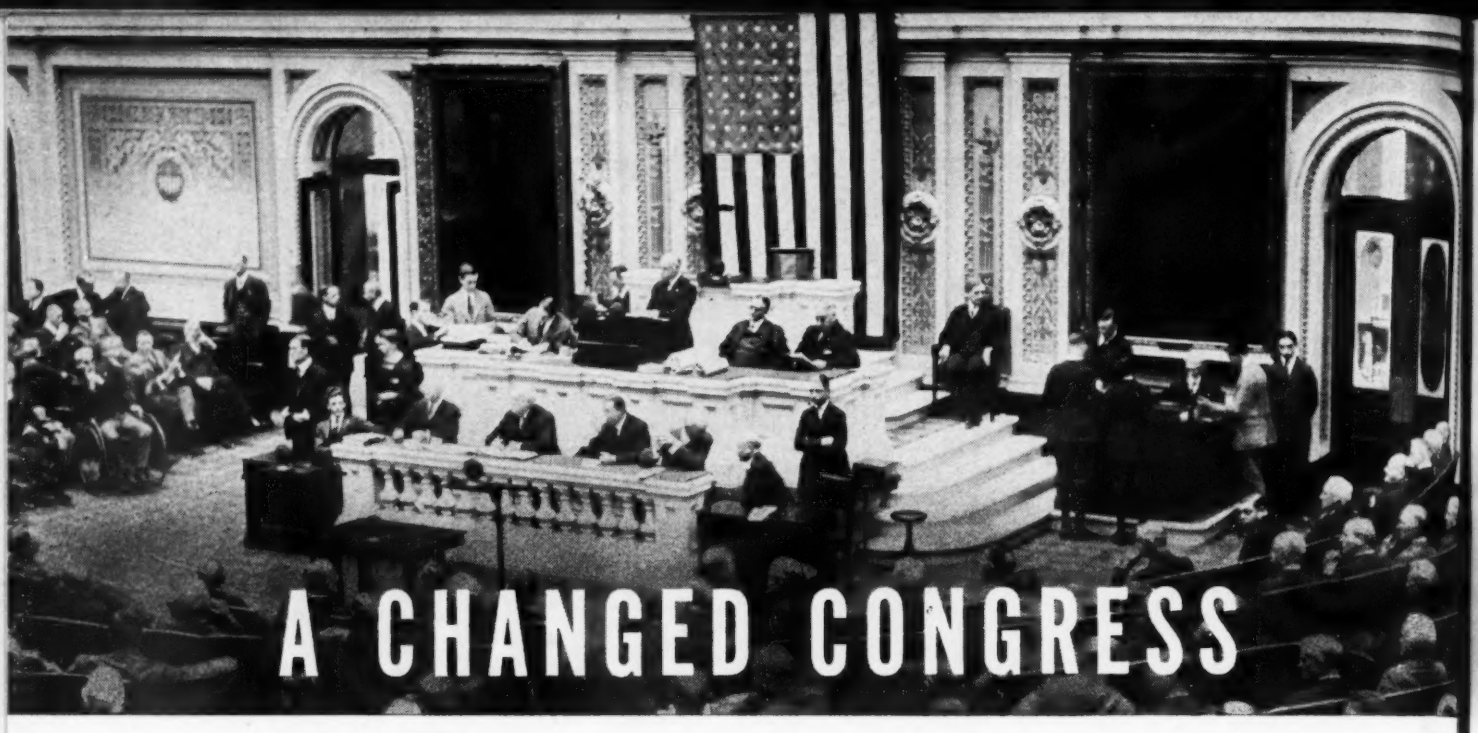



**FIG. 4—Details of each complete electronic control. Details of "throwover" to emergency cabinet are in Fig. 3**

**FIG. 5—Relation between output revolutions per minute and output voltage for a governor generator**





# A CHANGED CONGRESS

# May Check Public Power Drive

RICHARD N. LARKIN, *Associate Editor*

IT WILL TAKE MONTHS to determine to precisely what extent this month's elections may be considered a victory for private ownership of electric power, if it proves any victory at all.

Conversely, however, it took no longer than was required to count all the ballots to determine that the November 5 election was a serious, even drastic defeat for public ownership of electric power. The Republican landslide did not kill public ownership as a government policy, nor even approach this. Indeed, it seems true that power was an issue only in three states—Montana, Idaho and Washington, and there hardly the primary issue. The G.O.P. victory did not eradicate all public ownership supporters, nor install only private ownership adherents. In no sense can it be considered a mandate for private ownership of power.

### *Power Not an Issue*

In two particulars, however, the election cost public ownership dearly. First, the election drove from power in Congress the party which has been the public power party. Without attempting to assert that the Republican party is irretrievably wedded to private power, and numbers no public ownership men in its ranks, it has never been the pro-public ownership group that the Democratic party has been since 1933. Thus, control of Congress has been wrested from the actively pro-public ownership party, and because of this, any new public ownership gains will be slower, harder to get, less complete.

Although power ownership was not an important campaign issue, government control of, interference with, and competition against private enterprise was an issue—perhaps *the* issue. Power ownership is an integral part of such a picture, even though it remains to be seen to what extent it will be exploited.

Another important issue was federal economy, and again, the federal power program of the last 13 years is a part of this larger issue. It is difficult to believe that the Republican party will economize to the extent of forbidding enactment of pork barrel legislation with which much of the federal power program was intertwined; yet the economy sentiment might well extend to a point at which some of the ridiculous justifications for hydroelectric projects which have heretofore been permitted are no longer permitted, or further to the extent at which participation of private capital in economical developments is allowed. To the extent that either of these possibilities becomes a reality, public ownership suffered a defeat in the recent election.

### *Public Power Losses Heavy*

The second aspect from which November 5 can only be viewed as a serious defeat for public power lies in the identity of its supporters who lost their seats November 5 or earlier this year. In this regard, the mortality was tremendous.

For instance, of the 15 legislators who might be regarded as "first team" public power men in the Senate, seven faced election this year. Six of these were defeated, one had apparently won at this writing, another first string public power man moved from House to Senate. Of the seven who might be similarly described on the private ownership side of the fence, the one who faced election won. Thus, to the extent that these characterizations are accurate—and there will always be dispute as to the membership of such blocs—the 80th Congress' Senate has an entirely different complexion from that of the 79th.

In the House, where a much larger membership and many fewer roll call votes make it difficult to identify members of either "first team," the damage among public power ranks again was heavy, although not so heavy as in the Senate. Of 40 members who were particularly strong in support of public ownership, 15 were defeated, most of them in the November 5 election. Among the 20 House members who were among the strongest supporters of private ownership, only three were defeated.

### COMMITTEES

**HERE are the committees which will have greatest interest for the electric power industry, with their power jurisdiction and probable chairmen.**

| SENATE | HOUSE |
|---|---|
| **Agriculture**—REA—Capper, Kan. | **Agriculture**—REA—Hope, Kan. |
| **Appropriations**—Bridges, N. H., or White, Me. | **Appropriations**—Taber, N. Y. |
| **Public Works**—flood control, navigation, water power—Revercomb, W. Va,. or Robertson, Wyo. | **Interstate & Foreign Commerce**—interstate power transmission, securities—Wolverton, N. J. |
| **Public Lands**—irrigation and reclamation, interstate water compacts—Butler, Neb. | **Public Works**—Clason, Mass., or Dondero, Mich. |
| | **Public Lands**—LeCompte, Iowa. |

#### *Republicans to Organize*

Viewed in the light of the mechanics of legislating, the election was a defeat for public ownership. Both Houses will now be organized by the Republican party. An excellent example of this is the Speakership of the House. From this vantage point, Rep. Sam Rayburn did an unusually effective job of pushing through the bitterly disputed Southwestern Power Administration item in the last Interior Appropriations bill. The influence and prerogatives of the post he occupied enabled him to swing many votes which otherwise might not have been cast at all or might have been cast against SPA. His leadership of the abortive drive for an investigation of the "power trust lobby" contributed much to the effectiveness of the smoke-screen it was intended to raise, through which public power supporters rushed their project to relatively successful conclusion.

In the 80th Congress, Rayburn will not be Speaker. Without attempting to describe his anticipated successor, Rep. Joe Martin, as a private power man, there is no reason to expect that he would go to such lengths under similar circumstances.

Organizational processes vest control of committee chairmanships in the majority. Thus, the public power bloc, with more members among the Democrats than among the Republicans, loses these points of minor advantage whence its aims may be pursued. An example of the advantages lost here may be found in the light metals hearings held early in 1945 by the Senate Small Business Committee, under Sen. James E. Murray, one of the stronger public power Senators. Under his guidance, the hearings for a while were an imposing forum whence the Bonneville Power Administration could advance its light metals program which was a part of its "greater BPA" campaign. Next year, Murray will no longer be chairman of this committee. Mathematically, the chances of another public power man controlling the committee will be less than they were in the present Congress.

### LEGISLATIVE PROSPECTS

**HERE IS A SUMMARY of the principal power topics which are apt to arise in the 80th Congress and an estimate of the prospective action on each.**

**Rural Electrification**—Probably little curtailment of distribution line funds. Perhaps some amendatory legislation regarding generation and transmission loans, size of acquirable systems, etc.

**Hydroelectric Construction Funds**—Plenty of opportunity for economy here, but achievements probably will not equal possibilities. Congressional reaction to licensing of private power plants at public dams will affect this legislation minutely.

**Hydroelectric Authorizations**—Probably little curtailment of rivers and harbors and flood control omnibus authorization bills due solely to change in congressional control. Justification of hydroelectric features may tighten. Political considerations may transfer new authorizations to different areas.

**Power Policy Legislation**—Probably little extension of public power policy. Revision of existing policy, not necessarily dependent upon the change in control but perhaps favored by it, may result. Economy considerations make authorization of steam plants for federal systems even less likely than before.

**Valley Authorities**—Little real change in this prospect because they had almost no chance under a Democratic Congress. Tightening of TVA Act is more likely than its extension to other areas.

**Regulation**—Probably improved chances for amendment of public utility act of 1935 but as yet no real reason to expect much if any such legislation.

#### *Senate Loss Important*

The election returns provided dismal reading for the public power bloc in yet another regard—loss of Senate control. The Senate, being the more readily controlled body, tended to be the burial ground for displeasing measures which the public power bloc could not defeat in the House. It tended to repair damage to desired legislation which was inflicted in the House. Had the control of Congress remained divided, public ownership forces would still have been able to make effective trades between the two houses, for and against legislation in which they had an interest. This possibility now exists only to the extent that active supporters of public power in the Senate can sway their colleagues who have no particular leanings in either direction, and even this possibility is not particularly promising.

# VENICE *Has Success with*

FOR some four years the telephone company in Venice (Societa Telefonica delle Venezie) has had successful experience with a new type of patented conduit construction that does not provide continuous ducts for the cables. Instead the cable is supported at about 20-in. intervals by means of concrete diaphragms with inserts of insulating rings at uniform vertical and horizontal spacing. These diaphragms are of reinforced concrete. Sidewalls of the duct line are poured in forms after the diaphragms have been placed and aligned. The cables are installed before the reinforced concrete covers are placed and the excavation backfilled.

Advantages claimed are:

1. Low cost.
2. Rapidity of construction using prefabricated elements.
3. Installation can be inspected before closure.
4. Less strain on cables during installation due to reduced friction.
5. Cables remain dry because of drainage afforded.
6. Covers can be lifted for inspection (and in the case of faulted power cables a duct-splice made).

The holes in the concrete diaphragms are ringed with insulating material that is either vitrified sandstone, porcelain or glass so as to minimize sheath electrolysis. The rings are about 1 in. in radial thickness and about 2 in. in axial length. They are beveled so as to leave about a 1½-in. bearing surface. Outer surfaces are indented so as to key to the poured concrete and prevent loosening.

For the cables used the longitudinal spacing is from 16 to 20 in. so as to guard against deformation of the sheaths.

### *Provide for Drainage*

In order to leave space for drainage the diaphragms are blocked up about 2 in. from the bottom of the excavation. This tends to assure dryness of the cables and minimum adhesion of suspended matter to the sheaths. For power cables this would undoubtedly facilitate maximum carrying capacity for each value of earth temperature.

Cables in the Venice installation are 250- to 600-pair telephone cables and the manholes are from 230 to 280 ft. apart. There are six 4⅜-in. rings. The sidewalls and reinforced concrete cover are about 3¼ in. thick; maximum height over-all is 21 in. and the width 24 in.

### *Installation Procedure*

Initial step in the installation is to prefabricate the requisite number of diaphragms and cover-slabs, allowing ample time for setting and seasoning, particularly the covers. After excavation the first step in the field is to lay a non-reinforced concrete mat 4 to 5 in. thick the full width of the excavation. Blocks are then placed so as to raise the diaphragms about 2 in. off the bottom; these blocks are of such assorted dimensions that variations in vertical alignment of the diaphragms can be corrected.

Next move is to pour the sidewalls. The inside forms are set so that the diaphragms will key half way into the sidewalls. No reinforcement of the sidewalls is necessary. Before the

**FIG. 5—The insulating rings are keyed to lock into the diaphragms and chamfered to avoid chafing the sheath**

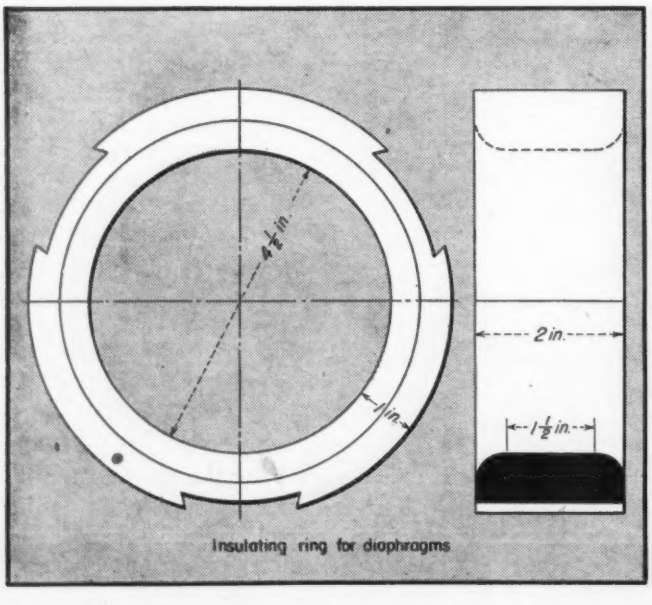
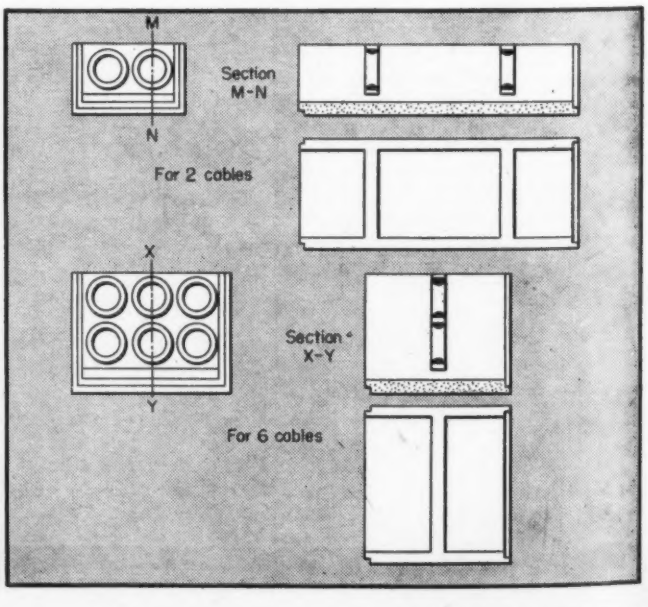



**FIG. 6—In some instances even the sidewalls (right) are precast or two-diaphragm sections cast intact**



# PREFABRICATED DUCT LINE

MARIO STOPPOLONI, *Ing. Mario Stoppoloni & Co.,* Verona, Italy*

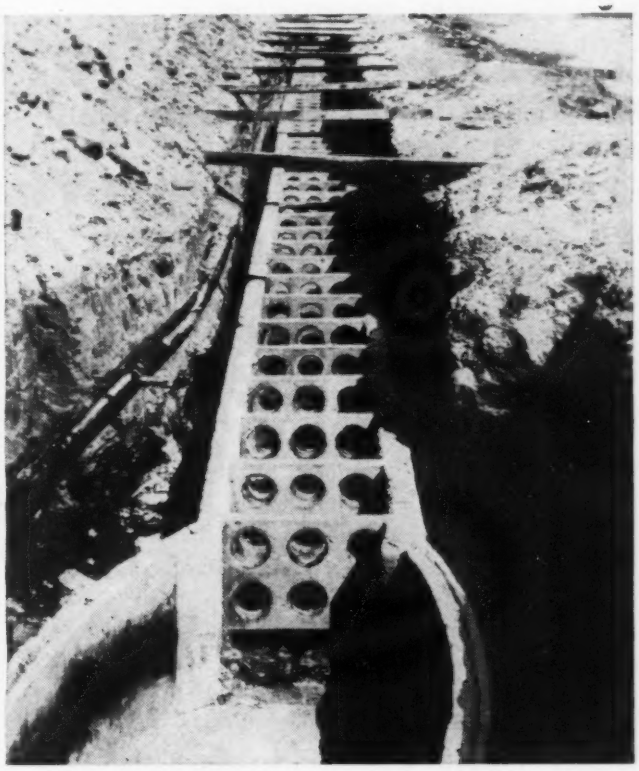


**FIG. 1—Precast diaphragm of concrete has cable orifices lined with insulating ring . . . FIG. 2—A run of diaphragm conduit (right) showing drainage clearance below diaphragms which are keyed into sidewalls**

walls have set the alignment is checked with straight edges.

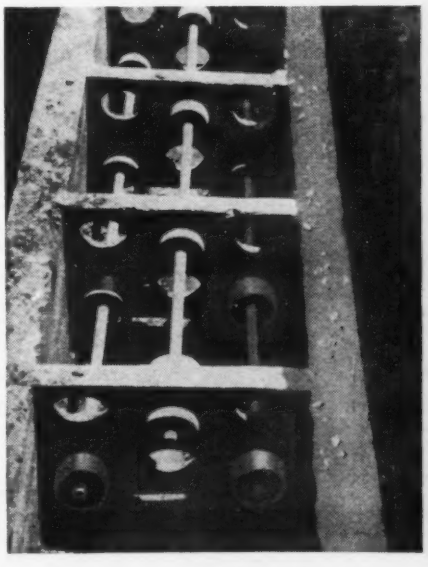
In an alternative given some consideration, portions of the sidewall were also precast in length sufficient to embrace two diaphragms. This appears to have merit for situations where traffic is heavy and interruptions must be minimized.

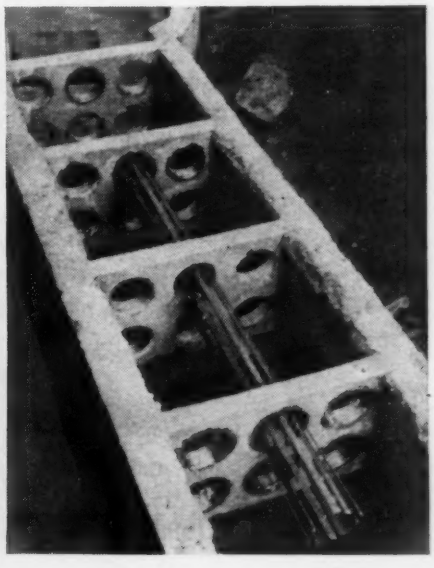
Cables can be threaded more readily into the successive diaphragm openings if a cage of flat strips is moved ahead as the cable is advanced.

After four years' service one such "prefabricated" duct line at Mestre was opened for inspection and test of the cables and sheaths. Everything was found in good condition, the cable sheaths were clean and there was no accumulation of deposits at the point of support.

*Telephone & Electrical Construction Limited Partnership Company.

**FIG. 3—Before sidewall concrete sets the apertures in the diaphragms are aligned . . . FIG. 4—To facilitate drawing in the cables a basket of flat straps (right) is fed in ahead of the nose of the cable**





# Electrical World OPINION

### *Again, the Coffin Award*

A DISTINGUISHED ROSTER is reopened. In 1947 the name of another power company will be inscribed on the list of recipients of the Charles A. Coffin Award. Except for 1944 when the whole industry was cited for its war achievement, the award has not been made since 1941. Now opportunity again offers itself for some company to receive recognition as "having made a distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry."

Without any foreknowledge of the contents of the presentations that will be submitted in the reopened competition for the award, or of what may be in the minds of the judges as they consider them, it can probably be predicted very safely that technical achievement will be less of a deciding factor than previously it has been.

Today, the dominating concern in power company operation is labor and the problems of policy it poses. It is our guess that when the Coffin award for 1946 is announced next June, it will have been made to a company showing outstanding accomplishment towards solution of the utility labor problem.

Equal to labor in importance comes selling. As has been pointed out many times, the power companies depend wholly on sales, on commercial enterprise, as justification of their continued existence as private business undertakings. Thus selling contributes heavily to "the benefit of the industry" and, certainly, it is commercial enterprise that does most to develop "electric light and power for the convenience of the public."

The terms of the Award specify the winner to have "achieved the greatest advancement in its operations and physical plant," thus by the inclusion of "physical plant" making technical progress a *sine qua non* for success in the competition. But in this day of social and economic readjustment, it does not seem that any contender relying on engineering accomplishment as its principal claim for consideration will have much chance to win.

In the accepted meaning of the word, there never has been, never will be, a "winner" of the Coffin Award. If there be a winner, then there must be losers. But no entrant in this competition was ever a loser in it. Each one won something greater than a certificate to hang framed in the president's office, more than $1,000 for an employees' benefit fund. That something greater is the value that always comes from examination of performance and appraisal of accomplishment, from putting these down in words and data so that they may be seen and known, not just by the judges in the competition, but by the people whose work thus is pronounced good.

### *Mr. Ferguson Retires*

SAMUEL FERGUSON, the dean of electric operating company executives, retired last month as president of the Hartford Electric Light Co. He will not be lost to the industry because he will continue as chairman of the board. Once before in 1935 he left the presidency of his company in order to be able to devote more time to the pressing problems of the industry. Although circumstances caused him once more to take up the reins in Hartford, he continued to devote a large amount of time and attention to the industry's problems.

Some men grow reminiscent as they reach three score and ten, but Samuel Ferguson has continued to look ahead. Anything of a constructive nature that the industry wanted to do to help its own cause not only found ready encouragement from him but active participation as well. He is among the last of that small group of strong men who though employed by one company belonged to an industry. "What does Sam Ferguson think of it?" has been the instinctive question raised for the past several years whenever any important matter of industry policy has been suggested.

It is fortunate that Mr. Ferguson's retirement from active management does not mean his retirement from the industry.

### *Getting Together on Farm Electrification*

FAR EXCEEDING expectations was the attendance at the first meeting of the National Farm Electrification Conference in Chicago early this month. This one fact overshadows every other aspect of the affair; it testifies to the prime present interest in the subject which, as stated by the chairman at the opening of the first session, is not the extension of rural service lines, but the intensive application of electricity to agricultural production.

As was natural, since they were the most active promoters of the Conference, manufacturers and power companies were most largely represented, comprising about half of those present. Representatives of government agencies, of educational groups including editors, and, notwithstanding Mr. Wickard, of farm electric cooperatives, with a small number whose interests were not identified on their registration cards, made up the remaining half of the attendance.

It was the aim of its originators that the Conference should not be dominated by any group, that no interest should be recognized as paramount except that of the

farmer This aim was given clear expression in the makeup of the program of the first meeting and in the discussions of papers. Straight in line with it was the election of Hassil Schenck of the Indiana Farm Bureau as chairman for the coming year.

Viewing these facts and developments, it is difficult to see how anything but an inflexible determination to cut off its nose to spite its face can prevent any agency concerned with farm electrification from joining the Conference. The job of putting electricity to work productively on America's farms is only started; it will never be finished, just as, even after 50 years, the end of industrial electrification is not in sight. The job is big and it is urgent; it is too big and too urgent to be hindered any longer by bickering, squabbling, and name-calling.

As a means for joining together all the interests, various in their methods and approaches, but at one in the single purpose of improving the agriculture of the country, ELECTRICAL WORLD commends the National Farm Electrification Conference, pledges support to it, and hopes all concerned will do the same.

### *The Coal Strike*

IN THE WORST coal supply position it has occupied in four years, the nation approaches a possible strike of coal miners. As of October 1 the supply on hand was sufficient for only 37 days of normal consumption. For the same date in the years back through 1943, the supplies were enough for 41, 43, and 45 days.

The coal strike last spring, lasting 59 days, drew down the stock piles of the electric utilities from 100 days' supply on April 1 to 72 on June 1. The figure of utility stocks for November 1 is not now available, but it can hardly be less than it was on October 1, 74 days' supply.

It does not seem possible that a coal strike this fall can last as long as did the one last spring. We were coming into summer then; now winter is just ahead. The Solid Fuels Administration has announced an October 1 figure of only 12 days' supply in the hands of retail dealers. A strike will soon exhaust that supply and a shivering population will exert strong pressure for some kind of arrangement to put the miners back to work.

To be set off against the probability that the strike will not drag out are certain facts of the electric utility situation. One is the remarkable increase in energy output that began last summer and has continued, setting record highs in the first two weeks of this month. Another is the amount of coal in stock. The present supply for 74 days is 18 days less than at the corresponding date last year. The record for the months from June to November shows that the normal building up of stock piles before winter was not accomplished this year, one cause undoubtedly being the increase in output and prices probably another. However, in view of the drawdown caused by the strike last spring and despite the probability that stocks will disappear faster in a strike this fall, it does seem that with reasonable conservation measures in effect present supplies are enough to go along on for some time.

In the news section of this issue of ELECTRICAL WORLD are figures of present coal stocks of 40 or more electric utilities. In the main, these figures approximate pretty closely the national average of 74 days for October 1 and support the assumption that the present average is about the same as then. Thus it appears that while a coal strike will probably pinch some electric utilities, the picture over-all need not cause immediate desperate concern.

### *Utility Strikes and Power Sales*

CONTINUITY and reliability of service is a strong argument of the power sales engineer. By purchasing electricity the industrial user has, in the usual case, better assurance that his production will not be stopped by failure of energy supply than he would have if he operated a generating plant of his own.

Fear now enters the thoughts of the power salesman that his strong argument of service reliability is weakened or destroyed by strikes of utility workers that cause interruptions of electric service. In his mind's eye he sees his industrial customer lending a more attentive ear to the siren song of competitive methods of power supply. He sees the finger of competition pointing to Pittsburgh, not as just an isolated case, but as the worst up to now of a series that began some years back and as yet shows no sign of ending.

This fear is not a foolish one. It has real cause. It is not merely a bogie to frighten timid souls. But, because fear lives on fear, it undoubtedly is magnified into intimidating shape all out of proportion to its actual substance. To cut the fear down to size, here is William E. Umstaddt, president of the Timken Roller Bearing Co., replying to a question asked by an editor of ELECTRICAL WORLD:

"We use a lot of electricity, of coal, of gas. But generating electricity, mining coal and supplying gas are not in our line of business. Our business is roller bearings, alloy steel, seamless tubing and rock drills. We might save a little by putting attention and money into production of our requirements of electricity, coal, and gas, any one or all of them, but we can make a lot more by devoting that attention and money to our own business.

"As for strikes, we have them, too. If we had our own electric plants, the few men running them could go on strike and throw thousands of our people out of work. I don't like to think of that possibility. Our plants are integral parts of the communities in which they are situated. If a utility strike stops or reduces electric service in one of these communities, we don't want our plant to stand out as being unaffected by it, because as we benefit by what helps the community so also should we share its troubles. Electric utility strikes have no effect on Timken policy as regards purchase of electricity."

## WASHINGTON COMMENT

By R. N. LARKIN

# Krug Vs. Lewis—A Showdown?

UNITED Mine Workers Chief John L. Lewis' latest tangle with the federal government has a number of angles which will be of more than passing interest to the electric power industry.

The first and most important, of course, is fuel supply for power generation. The current presentation of Lewis' periodic revolts against the public and the sanctity of contracts finds the power business, one of his best customers, less well prepared than it was last April. The latest figures of the Federal Power Commission find electric power utilities, as of October 1, holding 16,206,095 tons, or an average of 74 days' supply.

Precisely why the industry failed to rebuild stockpiles this summer to the extent it did during the corresponding period in 1945, when it raised its days' supply position from 73 to 92 from July to October, is not entirely clear. Perhaps the demand was such as to make stockpiling impossible despite the heavy output which has poured from the mines since settlement of last spring's two-month walkout. Another factor might be the heavily increased output of energy from mid-August to the present, which far surpassed the output during a corresponding period in 1945. This alone might reasonably be figured to have consumed 3,250,000 tons, or about 15 days' supply, which, at last year's rate of generation, would have gone on the stockpiles.

### *Krug at the Crossroads?*

The real interest to the power business lies in the other angles; for instance, in the performance of Interior Secretary J. A. Krug, as coal mines administrator for the federal government. This is not Krug's first negotiation with Lewis, for he was on hand last spring to negotiate the government-union contract under which mines have been operated since. As this is written, Washington is talking —wishfully perhaps—about a determined stand by the federal government against Lewis, and if this be realized, the broad, towering shoulders of Secretary Krug will have to carry the load.

Review of the numerous coal crises which have troubled the last five years will demonstrate that thus far the federal government has lost every brush with Lewis. Federal officials who were beaten to their knees by Lewis include the late Franklin Roosevelt and former Interior Secretary Harold L. Ickes. Whether or not this is to be Krug's turn remains to be seen. Depending on what administration strategy chances to be—and it may be evident in its entirety before this is printed—Krug may be on his own to get the best deal he can, or he may be a sacrificial lamb. Perhaps he will be the administration's spearhead in a real drive against Lewis.

### *A Candidate's Chance*

If the latter be the case, Krug will be taking with him a substantial portion if not all of his hopes for a political career. For a long time now, it has been widely believed in Washington and elsewhere that Krug has ambitions in the federal service which are not confined to the appointive branch. Since it is not unusual in American politics for a man to rise to great heights through a combination of circumstance and an outstanding achievement during public service, the stage today might be set for Krug to perform his version of the role which did so much for Calvin Coolidge and Harry Truman. Certainly if the Administration has decided that now is the time for the government to face up to Lewis and win, Krug has a sparkling opportunity. It would be difficult to think of any opportunity a public official could have today to win real public approval greater than that which could follow a striking assertion of the public interest over John Lewis' interest.

### *Lewis Nationalized Coal*

Strange is it may seem, there have been occasions when Lewis' opposition to the federal government's construction of hydroelectric plants gave rise to speculation as to the advantages of a liaison between the industry and Lewis. Any such liaison, of course, would be aimed by the industry at halting the federal drive toward nationalization of electric power. The industry must be thankful, these days, that nothing has come of such ideas, Lewis having achieved nationalization in his own industry. Intentionally or not, Lewis achieved this when he maneuvered the coal operators and the government into a position where nationalization became a fact, even though it has never been asserted as national policy to anything like the degree that nationalization of power has been asserted in law. Lewis having become the Cassandra of the coal industry, there would seem small chance that the power business will show much interest in enlisting his help to halt nationalization of its industry.

### *Untenable Grounds*

When he argues that hydroelectric facilities take bread out of the mouths of his coal miners, Lewis is on pretty untenable grounds with the power business, for it too is a devotee of hydroelectric plants under attractive conditions. Economically, this Lewis argument is just one phase of the "make-work" fallacy to which American labor has often demonstrated its addiction. It is this fallacy which management opposes so bitterly when other of its phases such as "feather bedding" or restrictions on productivity are advanced.

So long as Lewis' wind and limb hold out, he may be expected to do business at the old stand—higher priced coal for all uses, whether or not economic. Thus it should come as no surprise to whatever scientists first develop feasible atomic-electric energy to learn that they, too, are taking bread out of the mouths of Lewis' constituency.

# NEWS OF THE WEEK

## Soft Coal 'Frozen' to Assure Stockpile for Emergency Use

**CPA Prepared to Renew Controls over Utility Operations—Administration Will Be by States as During Spring Strike—Olds Predicts Disruption in East Would Follow Walkout**

TWO FEDERAL AGENCIES took preliminary steps this week to husband existing coal stocks for public utilities and other vital industries in the event that government's "showdown" fight with John L. Lewis failed to restore full operation of the mines.

Three orders issued by the Solid Fuels Administration "froze" bituminous coal standing at mines, in transit by rail, on shipping docks, and in retail dealers' yards as of November 16. These moves gave the government a stockpile of approximately 12,000,000 tons to be rationed for essential needs during any prolonged strike.

Distributors were authorized to release stocks only to public utilities, railroads, laundries, hospitals, and food processing and refrigeration plants which certified in writing that they had less than 10-days' supplies; to ship operators for bunker fuel, and to "hardship cases" among domestic consumers. No consumer eligible for emergency deliveries can receive more than a 10-day supply under these orders.

### *CPA Prepares Controls*

Civilian Production Administration prepared to renew some of its emergency controls over utility operations. CPA officials indicated that curtailment of electric service, probably similar to the plan ordered last spring (ELECTRICAL WORLD, May 11, Page 103), is due within two weeks after the strike starts; and restrictions on manufactured gas will go on as soon as the miners walk out.

Coal stocks held by operating electric utilities, though below normal, greatly exceed those of the manufactured gas industry in general. A prolonged strike, however, undoubtedly would necessitate some curtailment of all utility services, CPA officials said.

For the present, at least, CPA is not considering the revival of a separate control unit, such as the Office of Emergency Controls which functioned during the last coal strike. CPA will issue orders, but administration will be by states as it was during the strike last spring. Additions have been made to the staff of the Utilities Branch of the Equipment Division in order to study the effects of a strike upon the industry and to administer any controls which are invoked.

### *Utilities Stocks Below Normal*

The fuel situation among electric utilities was summarized generally in the affidavit presented in the District of Columbia Court by Federal Power Commission Chairman Leland Olds in support of the government's successful injunction petition to forbid the United Mine Workers, A.F.L., from calling a strike. Chairman Olds said that the electric utilities now have coal supplies sufficient for 60 days' operations, on the average, a supply considerably below normal for this season of the year. He predicted that a coal strike "soon would disrupt practically all electric systems east of the Mississippi River."

A preliminary survey of Federal Power Commission data on coal stocks held by electric utility companies on November 1 indicated that companies located in Northeastern and Midwestern states are better prepared for a stoppage of coal supplies than they were last April when the mine workers struck.

The list following gives a rough estimate of the stocks available to a number of representative companies, based upon their storage estimates for November 1 as compared with the amounts of coal used during October. A number of companies have not yet reported on their coal supplies at the beginning of November.

New England area: Public Service Co. of New Hampshire, nearly 2 months; Boston Edison Co. (October figures), 40 days; Northampton Elec-

**15 YEARS OF SAFETY—George S. Van Antwerp, left, vice-president of the Conowingo Power Co., Elkton, Md., presents an honor certificate to Lewis H. George, as safety chairman, commending the performance of the employees who have not had a lost-time accident in 15 years, during which 1,449,929 man-hours were worked. Observing the presentation is President Albert R. Granger**

tric Lighting Co., less than 1 month; Narragansett Electric Co., 250 days; Connecticut Light & Power Co., 1 month plus; Connecticut Power Co., less than 1 month; Hartford Electric Light Co., 5½ months.

Central Atlantic area: Buffalo Niagara Electric Corp., nearly 3 months; Central New York Power Corp., nearly 1 month; Consolidated Edison Co., 2 months plus; Long Island Lighting Co., 2 months; Jamestown (N. Y.) Municipal Electric Dept., 20 days; Jersey Central Power & Light Co., nearly 2 months; Public Service Electric & Gas Co., 2 months plus; Duquesne Light Co., 12 months plus; Pennsylvania Electric Co., 1 month plus; Pennsylvania Power Co., 4 months plus; Pennsylvania Power & Light Co., 5 months plus; Philadelphia Electric Co., 1½ months; West Penn Power Co., (Pa. plants) 1½ months; Chambersburg (Pa.) Electric Light Dept., (municipal) 15 days.

Middle West area: Cincinnati Gas & Electric Co., 1½ months; Cleveland Electric Illuminating Co., 1 month plus; Columbus & Southern Ohio Electric Co., 2 months plus; Dayton Power & Light Co., 1½ months; Ohio Power Co., 2 months plus; Ohio Public Service Co., (October figures) 1½ months; Chicago District Electric Generating Corp., 2 months; Indiana & Michigan Electric Co., 1½ months; Southern Indiana Gas & Electric Co., 2 months; Central Illinois Electric & Gas Co., 2 months; Central Illinois Light Co., 2 months; Central Illinois Public Service Co., 2 months; Commonwealth Edison Co., (October figures) 2 months plus; Consumers Power Co., 1 month plus; Detroit Edison Co., 3 months; Wisconsin Electric Power Co., 4½ months; Wisconsin Public Service Corp., 5 months.

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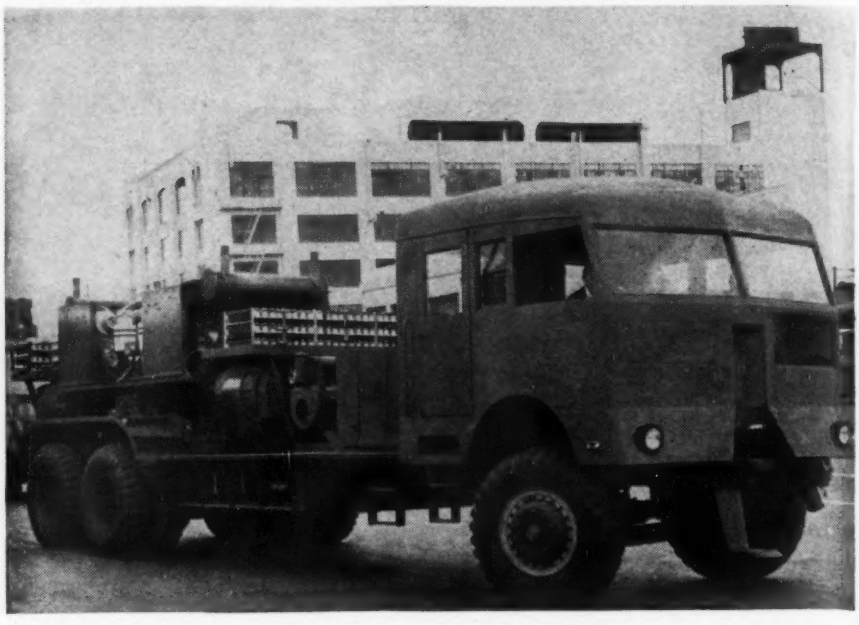
## Rochester Gas & Electric Plans 40,000-Kw. Station

Rochester Gas & Electric Corp. has announced plans for a generating station on the shores of Lake Ontario at Rochester, N. Y. Designed for an ultimate capacity of 160,000 kw., but one 40,000-kw. unit will be installed. The cost with one unit installed will be $8,000,000. The plant is to be in operation some time in 1948.

Each of the four units will include a boiler and one turbo-generator with all the necessary auxiliary equipment. The turbine will operate at 1,250 psi. at the throttle and at 950 deg. F. Water will be supplied through a pipe extending 4,000 ft. into Lake Ontario.



**ELECTRICALLY DRIVEN—This 60-ton, 40-ft., $400,000 truck was developed by the Army Ordnance Department in cooperation with the Knuckey Truck Co. and General Electric Co. The vehicle carries two 500-hp., gasoline-driven generator power plants each consisting of a Ford tank engine and a G.E. traction generator. Each generator supplies power to two electric traction motors which drive the four wheels (eight tires) through chain and sprocket. The vehicle may be operated with one or both power plants. Although intended primarily to serve as a dynamometer to determine the draw-bar pull of Army tanks over the rugged terrain at Aberdeen, Md., it can be used as a prime mover with a speed of 45 miles an hour. When acting as a dynamometer, load is provided by allowing the traction motors to act as electric generators. The electricity is dissipated through electrical circuits in the form of resistors made up of 5,880 ft. of strip metal**

## Conciliation Service Calls Utilities—Unions Meeting

The Edison Electric Institute has been invited by Director Edgar R. Warren, of the United States Conciliation Service, to send representatives to a meeting of utility and labor representatives at Washington, December 9, at which more effective means of resolving labor disputes affecting public utilities are to be discussed.

Invitations were issued after clearance with the Labor-Management Advisory Committee to Warren. Also invited were the American Gas Association; American Transit Association; International Brotherhood of Electrical Workers, A.F.L.; District 50, United Mine Workers, A.F.L.; Chemical Workers Union, C.I.O.; Transport Workers, C.I.O.; and Utility Workers Union, C.I.O.

The decision to schedule such a meeting represented a change in Warren's thinking of some weeks ago. At that time, (ELECTRICAL WORLD, October 26, Page 72) Warren sought an agreement among utility unions binding them not to strike without first using whatever means existed to settle such disputes without a disruption of service. The plan was concededly an attempt to head off legislation against utility strikes which might be enacted by the incoming 80th Congress.

Warren in his letter of invitation said:

"The Labor-Management Advisory Committee of the U. S. Conciliation Service at a meeting in my office this week discussed at some length the public interest concerning a more effective way of resolving industrial disputes in the public utility field. The committee is convinced, as I am, that in the public interest, as well as our own, the parties themselves should make every effort to find a method of settling any such disputes through voluntary means.

"I am inviting some of the representatives of the management and unions in the gas, electric light and power companies, and local transportation industries to attend an informal conference in Washington on Monday, December 9, to discuss these problems.

"No publicity is being given to the calling of this conference by the U. S. Conciliation Service."

Industry members of the Advisory Committee are V. Ahearn, National Sand and Gravel Association; C. E. Skinner, Auto Parts Association; Louis Ruthenburg, Servel, Inc., and H. W. Steinkraus, Bridgeport Brass Co.

# Scientists Seeking Solution of Atomic Power Problems

**Maj. Gen. L. R. Groves Releases Interpretive View of Status of Nuclear Power Developments—Preliminary Design of Oak Ridge Power Pile Shows Many Difficulties Must Be Overcome**

AN INTERPRETIVE VIEW of the status of nuclear power developments just released by Maj. Gen. L. R. Groves, shows that practical achievement of generation from uranium as a fuel is being prosecuted at Oak Ridge, Tenn., Hanford, Wash. and Chicago and is to be pushed at a new atomic power laboratory at Schenectady (ELECTRICAL WORLD, November 16, Page 8). General Electric participation will be under the direction of C. G. Suits.

The power pile program at Oak Ridge is now at the stage of putting together the preliminary design. Meanwhile, the problems which are being actively worked on are: the actual size and shape of the fuel unit, the method of transferring heat from the pile to the heat engine or the prime mover, the problem of loading and unloading the pile, the problem of automatic control of the pile and its accessory equipment, including steam turbine and generator, and the problems of shielding the whole unit for protection against radiation.

### *Experiments Come First*

"This pilot plant for nuclear power will be pushed to completion as rapidly as possible," said James H. Lum, director of Clinton Laboratories. "Numerous experiments must be made before final design can be settled. These experiments may well consume all of 1946 and part of 1947. The difficulties of procurement of equipment of this special category may also delay until 1948 the starting of the final pilot plant." Radioactivity requires heavy shielding and any pile, once operating, is difficult and dangerous to shut down for maintenance. The pile's first operation will be to provide heat energy for steam generation, operating at conventional central station temperature levels ranging from 650 deg. F. to 940 deg. F.

No indication may be had as yet of the capacity of the pilot plant. It is possible that all equipment will be relatively conventional from the boiler through the generator. None of the major components has yet been ordered, and their production would require months even in normal times.

Among the collaborators with Monsanto Chemical Co. at Hanford are: Allis-Chalmers Mfg. Co., Babcock & Wilcox Co., General Electric Co., Combustion Engineering Co., Consolidated Edison Co., Foster Wheeler Corp., National Carbon Co.

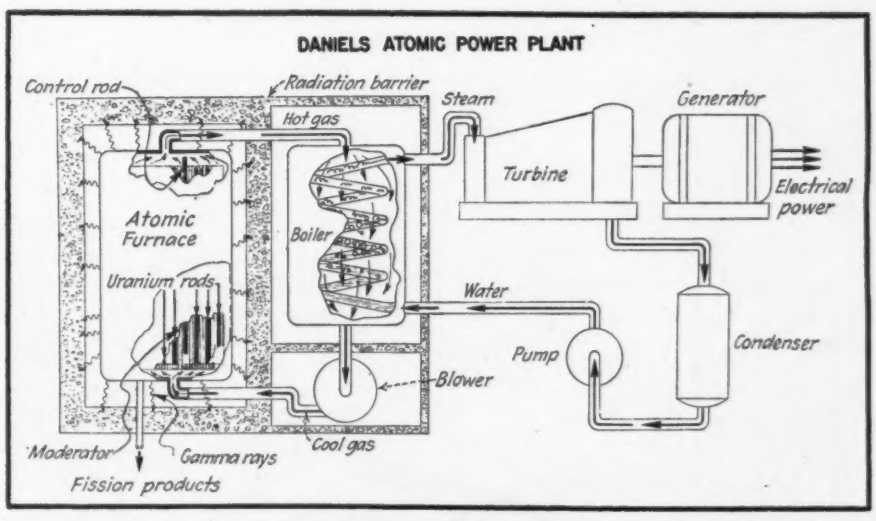
The Groves statement asserts that no device is at present known for extracting electrical energy directly from the uranium and that the current work is concentrated on adapting present power technique and equipment to the radically different fuel. Further, no element of a conventional power plant can be omitted when nuclear energy is used to replace our present forms of fuel, although fuel handling equipment will be greatly reduced in size and may be omitted entirely in plants designed to operate for a limited period of time.

Research is being directed toward a stationary power pile designed to last for many years, and to be capable of starting and stopping quickly, of being controlled continuously, with precision, over a wide range.

Materials must be found which will not break down under neutron bombardment. A suitable moderator to slow the neutrons down to the desirable speed must be employed in some pile designs, and this material must be capable of operating continuously at high temperatures. Choice of a heat transfer medium (conversely a pile coolant) involves probable selection among ordinary water, heavy water, gases, or liquids other than water. Several liquid metals are being studied, but little is known of their properties from a nuclear and corrosive standpoint. Since pumps, blowers, valves, and heat exchangers may become radioactive during operation of the pile, they must be so designated as to be trouble free and must require either no maintenance for extended periods of time or maintenance by remote control apparatus.

Radioactivity emanating from a power pile is the equivalent of tons of radium, and much of it persists even after the pile is shut down. Thick shields are required even for piles producing a relatively small amount of power, a major difficulty retarding the development of small atomic power plants or nuclear reactors.

Reviewing the cost estimates presented to the United Nations by Bernard Baruch, the statement by Gen. Groves indicates a $25,000,000 outlay for a 75,000-kw. plant which, operating at 100 percent capacity factor, should produce a kilowatt-hour for 8 mills, including fixed charges. Labor and supervision charges for the nuclear plants are expected to be greater than for coal burning plants but the boiler and fuel-handling requirements are likely to be less.




**PLAN FOR AN ATOMIC POWER PLANT**—Schematic diagram of the atomic power plant designed by Dr. Harrington Daniels, professor of chemistry at the University of Wisconsin and chairman of the board of trustees of the Argonne National Laboratory, Chicago. Monsanto Chemical Co., which operates the Clinton Laboratories at Oak Ridge, Tenn., for the government, is working on a power pile based on this preliminary design

## Samuels Gets REA Post; McCurley Succeeds Him

Maurice M. Samuels, chief of the Rural Electrification Administration's technical standards division since December, 1940, has been appointed special engineering consultant to REA Administrator Claude R. Wickard.

Mr. Samuels has been succeeded as head of the technical standards unit by James Bernard McCurley, Jr., of Baltimore, war-time director of the electrical engineering department at the U. S. Naval Academy.

A native of Lithuania, Mr. Samuels studied engineering in German technical schools and at the University of Freiburg. Coming to the United States in 1905, he was first employed as a draftsman by the General Electric Co. and later became associated with the engineering firms of Westinghouse, Church, Kerr & Co. and J. G. White Engineering Corp. of New York.

He joined the Washington staff of the Federal Power Commission in 1934 and was transferred to the commission's regional office in New York to conduct investigations for the Bureau of Power. In November, 1938, he was appointed to REA's operations and engineering division.

As a member of Administrator Wickard's staff, he will study major engineering problems confronting REA-financed power systems, agency spokesmen said.

Mr. McCurley, who is 40 years old, received his engineering degrees from Johns Hopkins and Yale universities. After graduation he was employed by the Chesapeake and Potomac Telephone Co. in Washington and Baltimore and at the Point Breeze, Md., plant of the Western Electric Co.

Entering the Navy in July, 1940, he was assigned to the Naval Academy as assistant, then acting head of the

electrical engineering department. He was discharged with the rank of commander in August, 1946.

Prior to his appointment to REA, Mr. McCurley was directing a group of engineers experimenting with proximity fuses at the Naval Ordnance Laboratory at Forest Grove, Md.

A member of the American Institute of Electrical Engineers, he was co-author and co-editor of a number of engineering manuals, including "A. C. Circuits and Machinery," "Electrical Engineering Laboratory Manual"—Naval Academy edition, "A Transformer Bridge, A.S.T.M." and "A Modified Schering Bridge, A.S.T.M."

## Union's Right to Peaceful Picketing Upheld by Court

**New York Court of Appeals Rules That State Anti-Injunction Law Prevents Action by Third Party**

Unions have a right to lawful and peaceful picketing even though third parties may be "injured or annoyed," the New York Court of Appeals has ruled in a case which involved a union and a building contractor, with the purchaser of a newly built home, a union of utility workers, and the Long Island Lighting Co. as interested or disinterested parties depending upon one's viewpoint.

The history of the case goes back to last November when the Building and Construction Trades Council of Nassau and Suffolk Counties tried to induce William J. Levitt, head of Levitt & Sons, contractors, to employ union labor on a housing project in the North Park area of Roslyn Heights, L. I. When Levitt refused the request, the union set up a picket line.

George R. Schivera moved into his new home, but utility workers, members of the International Brotherhood of Electrical Workers, A.F.L., refused to cross the picket lines. Mr. Levitt then complained to the New York Public Service Commission which ruled 4 to 1 that Long Island Lighting Co. still had the duty of supplying utility services (ELECTRICAL WORLD, January 12, page 7).

The next step was the securing of an injunction by Mr. Schivera to halt the picketing. The union went to the Appellate Division of the Supreme Court and had the injunction dismissed. The 4 to 3 decision handed down recently by the Court of Appeals was in support of the Appellate Division decision.

In its decision the majority of the Court of Appeals ruled that the state's anti-injunction statute deprived the court of any jurisdiction in the matter. It pointed out that a third party such as Mr. Schivera "can always be found by the disputant who wishes to enjoin his adversary" and that the "whole purpose of the anti-injunction statute would be neatly and effectively thwarted if such an injunction were available to an outsider (in a labor dispute) injured or annoyed by peaceful and lawful picketing."

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## Import and Quota Controls on Lead Dropped by CPA

The Civilian Production Administration this week dropped its import and quota restrictions on lead and ordered the cessation of government imports of lead and copper. This action had been expected since the termination of price controls.

The new CPA orders do not terminate all that agency's metals controls. The 25 percent set-aside of domestic lead production continues in effect to maintain a pool for domestic hardship cases. Imports of both lead and copper will continue until the end of the year because of contracts with foreign producers. Actual imports of the two metals under these contracts probably will cease in February.

The lead stockpile of 38,000 tons remains "frozen" for emergency use in public health and safety projects. A similar reserve of some 200,000 tons of copper also is being reserved for emergency use for civilian purposes. CPA is retaining inventory controls on both metals, for the time, at least, to prevent hoarding and unbalance of industrial inventories.

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## Charles E. Stephens Dies

Charles E. Stephens, who was a vice-president of the Westinghouse Electric Corp. at the time of his retirement last year, died on November 19 at his winter residence in Delray Beach, Fla. Mr. Stephens completed 45 years of service with Westinghouse and during a large part of this time was an outstanding leader in the electrical industry.

## Small Utility Merged

Hammond Light & Power Co., Hammond, N. Y., has been merged into the Central New York Power Corp. The Hammond utility also served Chippewa Bay and had but 253 customers.

# N.A.R.U.C. Delegates Warned of Encroachment on States

**President Biggs Calls for Resistance by State Regulatory Bodies to Federal Moves—Methods of Minimizing Effects of Deflation on Utilities Outlined by Massachusetts Man**

PROBLEMS of interest to state regulatory bodies, among them federal encroachment and utility rates, formed the program for the 58th annual convention of the National Association of Railroad and Utilities Commissioners held November 12-15, at Los Angeles. Attendance was about 300 with delegates present from all sections of the United States, Puerto Rico, and Hawaii.

President John D. Biggs, chairman of the Illinois Commerce Commission, warned against the "present drift toward centralization of government power in Washington." He described several cases during the past year in which the destruction or curtailment of state regulatory power was threatened in several ways and pointed out that such threats of federal encroachment will continue and will prove successful unless they are steadfastly resisted by the association and the individual state regulatory bodies.

### *Reproduction Cost Important*

Reporting as chairman of the Committee on Service and Facilities and Safety of Operation of Public Utilities, George H. Flagg, Public Utilities Commission, Oregon, said that various companies have for a long time contended that reproduction cost is the controlling consideration in arriving at a rate base. However, his committee is of the opinion that "reproduction cost never has been the exclusive or controlling consideration in the finding of a rate base, but there have been many cases which have held that reproduction cost was one of the elements which must be considered." He said that there now is a "tendency on the part of the courts and the commissions to reduce the importance of the reproduction cost."

The hazards facing utilities in times of depression were outlined by Francis M. McKeown, Massachusetts Department of Public Utilities, and chairman of the Committee on Rates of Public Utilities. "During the past several years," he said, "many utilities have expanded their facilities and their loads abnormally to meet the war effort. The upward trend of labor and material costs is continuing, but in the meantime the utility loads and revenues are in many cases being reduced."

Both an impaired financial condition and rate increases are to be avoided if possible, and the object of regulatory commissions, both state and federal, "should be to assist and direct the utilities in a manner calculated to produce and retain a sound, healthy, and growing industry."

Four methods of minimizing the effects of deflation were suggested by Commissioner McKeown. They are an aggressive load-building program, a review of rate structures to improve rates which tend to curtail use of the utility's service, reduction of mortgage debt, and profit-sharing programs to maintain adequate rates, with provisions for annual credits on consumers' bills large enough to reduce excessive earnings to a reasonable level.

Public ownership of utilities may result if regulation is not equitable, Richard Sachse, Federal Power Commission, and chairman of the Committee on Valuation, warned. "Inequitable rate burdens will breed discontent and spur the search for relief outside of regulation. The public is not helpless and can make its choice between regulated private utility service and public ownership and operation," the former California Railroad commissioner said.

**OFFICERS — Walter H. McDonald, left, newly elected first vice-president of the N.A.R.U.C., and John D. Biggs, retiring president of the association**

Duane T. Swanson, Nebraska Railway Commission, was elected president; Walter R. McDonald, Georgia Public Service Commission, first vice-president; and Justus F. Craemer, California Railroad Commission, second vice-president. General Solicitor Frederick G. Hamley, Secretary Ben Smart, and Assistant Secretary Stanley Allyson, all of Washington, were re-elected.

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## Great Lakes Power Club Told of Selling Techniques

Induction heating, resistance furnaces and other production techniques shared attention with electronic measuring devices and selling techniques in a one-day program of the Great Lakes Power Club, meeting at Milwaukee last week. The 112 members present were told that the electricity selling job must be expanded to include more general knowledge of new devices that will aid production.

Kenneth F. Ode, Falk Corp., said that industry needs the specialized help that the power salesmen can give in finding places for applying electricity. Power selling today means being familiar not only with the new processes but also knowing where they fit into a customer's plant, he said, emphasizing that industrial plant engineers depend on the power company man for an unbiased opinion of the best equipment for a particular need.

Burr J. Martin, B. J. Martin & Co., said that production must be increased and that increased use of electricity is the principal means for doing this. Howard A. Boltz, Detroit Edison Co., concluded an outline of electronic measuring devices with the observation that they do not use much power but that they aid in production which does increase the power load.

Precision control possible with electric furnaces accounted for the large acceleration in their use during the war, said Arthur Frank, Hevi-Duty Electric Co., pointing to cleanliness and quiet operation in the plant as advantages added to higher efficiency compared with other methods of heating.

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## Municipal Plant Rejected

**A bond issue to finance the purchase or construction of a municipally owned power plant was defeated recently by the voters of Portsmouth, Va., which is now served by the Virginia Electric & Power Co.**

# Arizona Utilities Act to Bring Boulder Dam Power to State

**Organize 'Electric Coordinating Committee' and Claim That They Can Get Power $1,000,000 Less Annually than Arizona Power Authority Which Has Plans for Setting Up Own Lines**

AN "Electric Coordinating Committee" that maintains it can obtain and distribute Boulder Dam power in Arizona at a $1,000,000 annual saving over rates offered by the Arizona Power Authority has been formed by major Arizona utilities, the Salt River Valley Water Users Association, and the San Carlos (Federal Reclamation) Project.

Members of the committee are J. R. Snider, Tucson Gas, Electric Light & Power Co.; C. H. Reed, San Carlos Project; Philip B. Shaw, Arizona Edison Co.; Malcomb M. Bridgewater, Arizona Power Co.; Henry B. Sargent, Central Arizona Light & Power Co., and H. J. Lawson, Salt River Valley Water Users Association.

Lin B. Orme, president of the Water Users Association, called the utility representatives together to formulate a "practicable and workable plan and solution" for introduction of Boulder Dam power into the state.

### *No Boulder Dam Power in 10 Years*

He said that since Boulder Dam's completion March 1, 1936, "no constructive action has been accomplished by public agencies toward bringing in either Colorado River power or water."

"The Water Users Association and Central Arizona Light & Power Co. took the lead in bringing in Parker power," he continued. "We would like to take the lead in bringing in Boulder power. We are a non-profit corporation and therefore cannot hope to benefit from it other than as it may benefit our customers. With the corporation commission regulating rates in this state, any savings made by private utilities in the state naturally revert to their customers."

Rates proposed by the authority are "far in excess of what we believe they should be," Orme said. He added that Water Users' officials believed that contracting for the full amount of Arizona's Boulder power by the utilities would save $1,000,000 over the rate the authority offered, allowing marketing in Central Arizona at 3.2 mills per kw.-hr.

The Power Authority met formation of the committee with a sharp challenge both of its motives and of the legality of the proposal. The state agency declared that it had jurisdiction over allocation of Boulder power granted to Arizona.

The authority continued:

"The six major utilities which . . . have for 20 years fought the creation of a state agency to obtain Boulder power—thus bringing about repeated power shortages with damages to citizens of Arizona running into millions of dollars (ELECTRICAL WORLD, August 10, Page 9)—now challenge the right of the people of Arizona to obtain this power, so eminently a part of their natural resources."

Terming the newly formed committee's claims "extravagant," the authority accused representatives of the Water Users Association of telling "every legislature since 1926" that power supplies in the state were ample, statements that allegedly resulted in "power shortages . . . damaging to industry and agriculture in 1937, 1938, 1940 and 1941."

The authority quoted a statement by Lawson before the legislature in 1943 that Boulder Dam power could not be brought in any cheaper than existing rates, 6 mills. He also described the bringing in of Boulder power as "a wild dream of promoters who know nothing about the power business," the agency added.

The authority further charged that "at the very time Orme and Lawson were appearing as spokesmen for the power trust and declaring there was no need for this (Colorado) power and that there was a surplus of power in Arizona, they were secretly negotiating for Parker Dam power which they obtained at about 2 mills per kw.-hr. and are now retailing in Phoenix at about 600 percent higher than the purchase price."

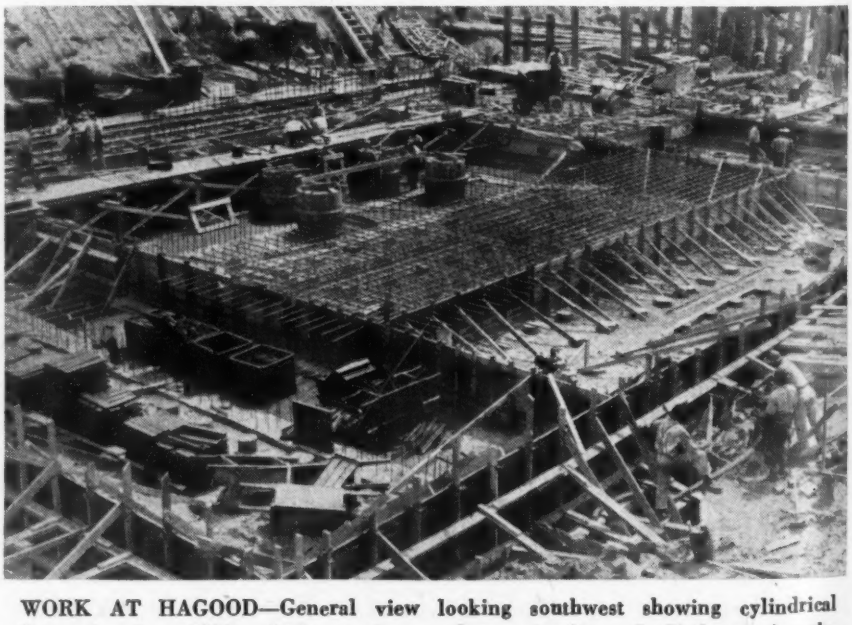
The authority early in October announced plans for a self-liquidating $30,000,000 program of high-voltage transmission line construction and installation which is to supply electric power from Boulder and other Colorado River dams to nearly all parts of the state. It was this program of the authority which brought the opposition of the utilities.

## MEETINGS

**Previously Listed**

**American Society of Mechanical Engineers**—Annual meeting, Hotel Pennsylvania, New York, December 2-6.

**National Exposition of Power and Mechanical Engineering**—Grand Central Palace, New York, N. Y., December 2-7.



**WORK AT HAGOOD**—General view looking southwest showing cylindrical forms in the middle which are for condenser intake and discharge for the $2,795,000 steam electric generating plant of the South Carolina Power Co. at Charleston. Initial installation at Plant Hagood will be a 22,500-kw. unit

# SEC RULINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

ASSOCIATED ELECTRIC CO. has been authorized to acquire 10,700 shares of reclassified common stock of South Carolina Electric & Gas Co. from General Public Utilities Corp., in the form of a dividend. South Carolina Electric & Gas Co. is a subsidiary of the General Gas & Electric Corp., which is a wholly owned subsidiary of General Public Utilities Corp. Associated plans to pledge the shares as additional collateral for its outstanding debentures. Associated holds 107,000 shares of General Public Utilities common, now pledged to secure the debentures. General Public Utilities is distributing reclassified South Carolina common as a dividend, at rate of one-tenth of a share for each share of common held. The commission directed that Associated shall divest itself of the South Carolina company shares when they are no longer subject to lien of indenture securing its debentures. (Release No. 6969).

NIAGARA HUDSON POWER CORP. has been given until May 1, 1947, to dispose of its holdings in its subsidiary, Buffalo Niagara Electric Corp. The company had asked a year's extension from November 1, 1946, but the commission stated it appears the proposed disposition can be consummated within a shorter time. However, it gave the company the privilege to ask for additional time if required. (Release No. 6963).

CENTRAL ILLINOIS PUBLIC SERVICE CO. has been granted authority to shorten from the usual ten days to six days the time allowed for acceptance of bids on its 150,000 shares of new preferred stock. The shares will be sold at competitive bidding subject to an offer of exchange on a share basis to public holders of its present preferred. The company was also given commission authority to shorten from ten days to four days the effectiveness of the exchange offer. (Release No. 6974).

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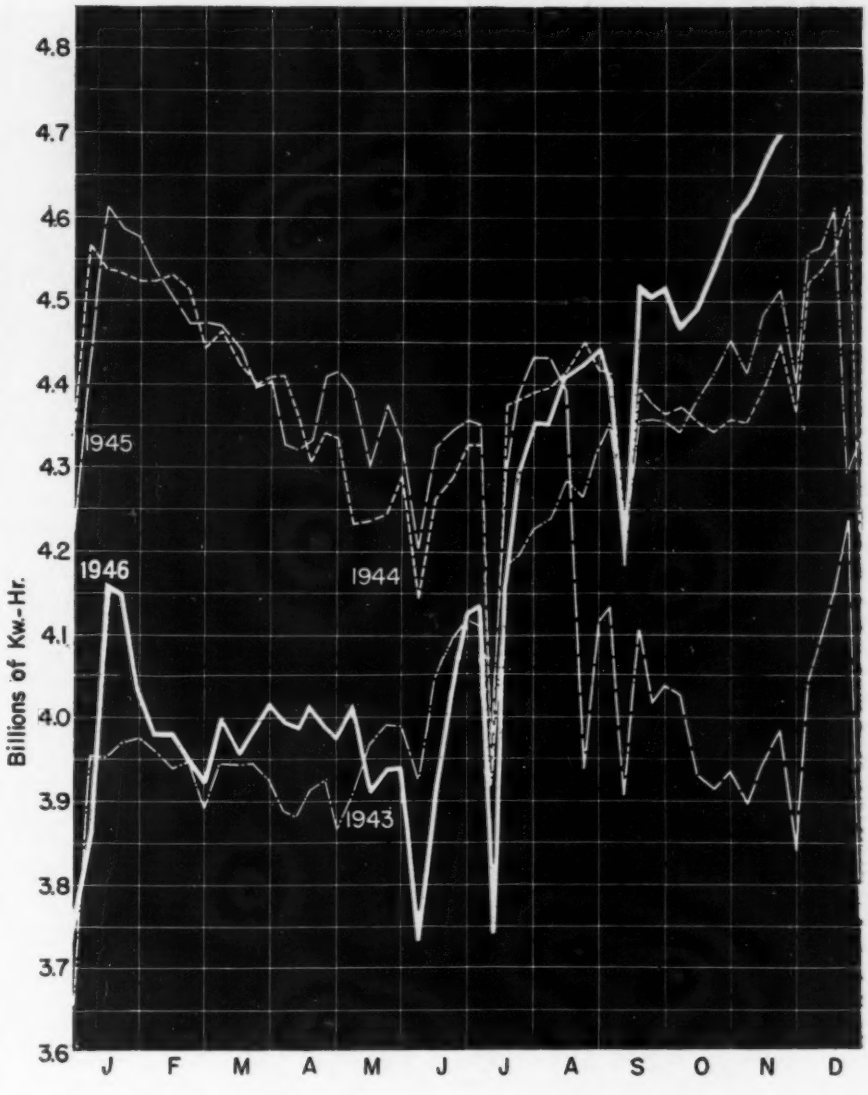
## P.U.D. Gives Pay Raise

A new wage agreement with the International Brotherhood of Electrical Workers, A.F.L., has been approved by the Benton County P.U.D. of Prosser, Wash. Retroactive to September 13, the new scale, affecting all electrical workers of the district, raises wages an average of 10 cents an hour above those specified in the Pacific Power & Light Co. union agreement, J. B. Whitehead, P.U.D. manager, said. The P.U.D. recently took over Pacific Power properties in the county. The scale now ranges from $1.20 an hour for ground men to $1.65 for linemen. Line foremen will draw $1.85 an hour. Double time will be paid for all overtime.




## Output Hits New High for Third Week

The electric output curve during the week ended November 16, 1946, made a new high record for the third successive week, according to figures released by the Edison Electric Institute.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,699,935,000 kw.-hr. The previous high was 4,682,085,000 kw.-hr. for the preceding week ended November 9. During the week ended November 17, 1945, the amount of electrical energy distributed totaled 3,984,608,000 kw.-hr., this year's figure representing an increase of 18.0 percent. The over-all percent change for the country as a whole for the week ended November 9 was an increase of 18.6 percent.

Again the Southern States reported the largest individual increase, 28.3 percent, with the Pacific Coast group running a close second, 26.5 percent. The changes as a whole were not substantial when compared with those reported for the preceding week.

**Weekly Output, Millions Kw.-Hr.**

| 1946 | | 1945 | | 1944 | |
|---|---|---|---|---|---|
| Nov. 16 | 4,700 | Nov. 17 | 3,985 | Nov. 18 | 4,450 |
| Nov. 9 | 4,682 | Nov. 10 | 3,948 | Nov. 11 | 4,397 |
| Nov. 2 | 4,628 | Nov. 3 | 3,899 | Nov. 4 | 4,355 |
| Oct. 26 | 4,602 | Oct. 27 | 3,937 | Oct. 28 | 4,358 |
| Oct. 19 | 4,540 | Oct. 20 | 3,915 | Oct. 21 | 4,345 |
| Oct. 12 | 4,495 | Oct. 13 | 3,934 | Oct. 14 | 4,355 |
| Oct. 5 | 4,478 | Oct. 6 | 4,028 | Oct. 7 | 4,375 |
| Sept. 28 | 4,518 | Sept. 29 | 4,039 | Sept. 30 | 4,366 |
| Sept. 21 | 4,507 | Sept. 22 | 4,019 | Sept. 23 | 4,377 |
| Sept. 14 | 4,521 | Sept. 15 | 4,106 | Sept. 16 | 4,395 |
| Sept. 7 | 4,184 | Sept. 8 | 3,909 | Sept. 9 | 4,228 |
| Aug. 31 | 4,404 | Sept. 1 | 4,137 | Sept. 2 | 4,415 |

**Percent Change from Previous Year**

| | Nov. 16 | Nov. 9 | Nov 2. |
|---|---|---|---|
| New England | +10.6 | +11.7 | +12.4 |
| Mid-Atlantic | + 9.0 | + 9.7 | +10.0 |
| Central Industrial | +16.0 | +16.7 | +15.0 |
| West Central | +11.3 | +14.5 | +14.0 |
| Southern States | +28.3 | +28.2 | +31.0 |
| Rocky Mountain | +13.9 | +15.3 | +10.3 |
| Pacific Coast | +26.5 | +26.0 | +27.3 |
| Total United States. | +18.0 | +18.6 | +18.7 |

## California Group Studies Effect of Costs on Rates

**Municipals Advised to Up Rates Promptly if Necessary—Federal Power Sale Price Called too Low**

Rising costs and their effect on rates were considered in many aspects by the California Municipal Utilities Association at its annual meeting, November 7-8, at Riverside, Calif.

Lester S. Ready, consulting engineer, in discussing trends in utility rates said "future rate reductions measured in cents per kw.-hr. or money should be postponed at least until the effect of rising costs can be evaluated and the form of rates can be determined on a sound basis. If increases are necessary they should be made promptly and prior to the temporary recession or settling down that may be expected within the next two or three years."

Warning against the dangerously low domestic rates promulgated by federal agencies, Ready declared "both TVA and Bonneville have proposed especially low rates for domestic service, specifying a 5-mill rate per kw.-hr. for a block of energy between 200 and 1,100 kw.-hr. per month, and a comparatively low rate for all excess consumption. These rates are extraordinarily low in the light of the average family's inflated income. Fortunately the California municipalities have not been intrigued so far to any great extent by these politically expedient rates. However, the federal authority is pushing its ideas and expanding its system. Unless it does an about face, the utilities may soon be faced with the necessity of combating the government's unsound program of domestic rates."

***Utility Costs Up 29 Percent***

Over-all utility costs increased 29 percent from 1935 to 1946, clearly indicating the effect to date that the rise in labor and material costs have had, said Samuel Morris, general manager, Los Angeles Department of Water & Power. Fortunately, he continued, there is reason to believe that we are at or near the peak of prices and costs. Despite these cost increases, he does not believe that rates will have to be increased. Los Angeles will shortly announce a general rate reduction of $1,500,000 annually.

Laws will not prevent strikes, declared Thomas Neblett, labor relations consultant. His solution would be for management to take the initiative and the use of the conference room as an antidote. Most disputes arise from ignorance and distorted facts, he asserted.

**MUNICIPAL ASSOCIATION OFFICERS—Left panel, G. A. Baxter, president, and Lauren W. Grayson, member of board of governors and chairman of the convention. Right panel, J. H. McCambridge, vice-president, and F. V. Frey, secretary**

Carl A. Heinze, consulting engineer, carefully analyzed factors affecting choice of units for small utilities and said that the substantial economies offered by outdoor or semi-outdoor generating plants should not be overlooked in proposed new construction.

Glenn A. Baxter, secretary, Public Utilities Board, Alameda, and F. V. Frey, supervisor, Light & Power Department, Pasadena, were reelected president and secretary, respectively.

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## Oregon Power Shortage Eased by New BPA Line

Bonneville-Grand Coulee power began flowing into the system of the Central Lincoln P.U.D. at Toledo, Ore., in mid-October, easing a power shortage in central Oregon which has blacked out communities for days at a time.

Dr. Paul J. Raver, BPA administrator, said the arrival of power from the Columbia River plants and the temporary addition of portable generating equipment at Florence will stabilize service and improve low voltage throughout the system pending district construction of heavier transmission facilities and Bonneville building of a Eugene-Reedsport line which will supply the southern end of the P.U.D.

The 115-kv. Albany-Toledo line was planned before the war but was delayed by war-time restrictions and later by material and labor shortages.

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## Picket Lines Stop Service

Employees of the Iowa Power & Light Co. have refused to cross picket lines at a building project in Des Moines set up by A.F.L. building unions.

## Examiners Find 2 Co-ops Unfair to Union Workers

Findings of unfair labor practices have been made against two REA power cooperatives by trial examiners of the National Labor Relations Board. If the findings are affirmed by the board proper, each cooperative will have to reinstate two employees with back pay.

Involved are the Tishomingo County Electric Power Association, Iuka, Miss., which also is refusing to bargain with the International Brotherhood of Electrical Workers, A.F.L., and the Tri-County Electric Cooperative, Rushford, Minn.

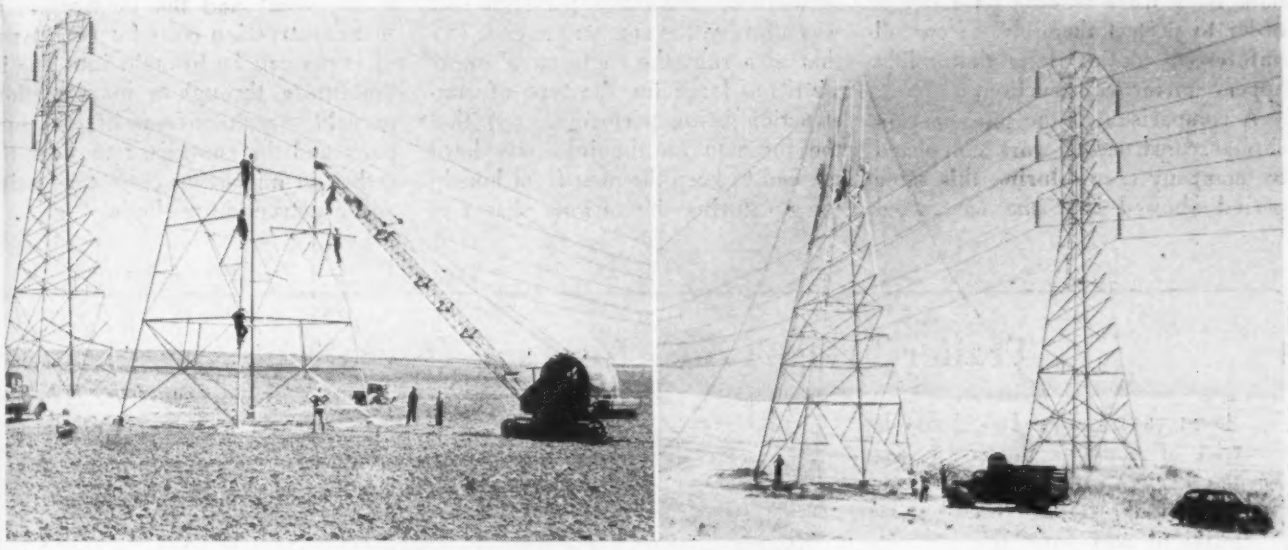
The former will be required to rehire two linemen with back pay from April 21, 1945, at which time the men offered to return to work after having been on strike twice; bargain with the I.B.E.W. for all outside workers except supervisors; and cease from discouraging union membership. The linemen struck in November, 1944, and again in February, 1945, over the co-op's refusal to recognize the union, although it had agreed to meet union terms. The three men now employed in the bargaining unit are non-union.

While the Tri-County cooperative has recognized an independent union certified last July as bargaining agent for office and outside employees, it is accused of having discharged a line superintendent and a district lineman last June because they were instrumental in forming the union. By agreement, however, the line superintendent was not himself included in the union's jurisdiction when the consent bargaining rights election was held.

Claims of both organizations that they were not engaged in interstate commerce within the meaning of the Wagner Act were rejected.

# HOW

**DESIGN • CONSTRUCT • OPERATE • MAINTAIN**



**BASE SECTION of tower is erected with aid of tractor-mounted boom (left). Follow-up crew tops out and completes the tower panel by panel, by hand erection method, utilizing a gin pole, as shown at right**

## Crane Aids in Tower Erection

IN BUILDING its second Pit River 220-kv., double-circuit steel tower line, Pacific Gas and Electric Co. is using the crane illustrated to good advantage. Method of erection is a compromise between straight hand work and use of a derrick with 100-ft. or longer boom, and was found to be especially well adapted to the character of the land traversed. For 100 miles or more the line passes through many rice fields and slightly rolling farming and grazing country where the extra long boom used successfully by some other utilities would have found limited use. Moreover, such equipment was not readily obtainable. The adjacent hot line would also have further hampered use of an extra-long boom.

However, the tractor-mounted, 47-ft. equipment shown was well suited to erecting the towers, panel by panel, up to the top caged section. This latter was topped out by hand erection by a follow-up crew using a gin pole as illustrated.

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## Experience in Contracting Rural Line Construction

**GLEN R. GEORGE**
The Washington Water Power Co.
Spokane, Wash.

MANAGEMENT is continually faced these days with the problem of rising material and labor costs. If electrical contractors can complete rural line jobs within reasonable limits of company estimates, then they definitely have a place in the future construction programs of electrical utilities. In 1944, the demand for electric service in orchard and irrigation areas on the Washington Water Power system, that would qualify under WPB restrictions, became so heavy that additional help was required. Electrical contractors were given these distribution construction jobs to do on a cost plus basis. No attempt was made to segregate the jobs in any one district between small and large extensions for the contractor.

The division superintendent assigned the jobs as they were approved by management either to a company crew or a contractor's crew. The only limitations were that temporary headquarters for contractors' crews were maintained in a district for at least a three-week period before a second group of jobs was assigned in another district. After three months, this rush work subsided to the point that contractors' crews were then assigned to rural line extensions in other parts of the system. These rural jobs were done on a firm bid basis with allowances for extra rock work encountered. Extensions varied in length from 4 to 15 miles. All were clear-cut in nature as compared to the previous work, which often involved the company's existing distribution construction.

A cost analysis at the end of the

year showed that the average for the cost plus jobs was less than those built on a firm bid basis, like types of jobs being considered. All overhead and fixed charges being the same in both cases, this difference was due to the contractors using a higher man-hour basis when *bidding* on a job in order to protect themselves from all unforeseen contingencies that might appear during construction.

A comparison of the final cost on similar construction work completed by company crews during this same period showed that the contracted jobs were somewhat above the company's cost figures per mile of line. From field observation it was concluded that four things tended to increase the cost of the jobs performed by the contractor compared to company crews: (1) That the contractors' crews lacked the field supervision that was afforded the company crews, (2) that as a rule, the contractors' crews were too large for the type of construction being performed, (3) that the foreman on the jobs was hard pressed to keep the men from bunching up during the various phases of the work, (4) that the new linemen and groundmen took some time to become organized into a smooth-working line crew and this tended to slow down, at first, the daily production of work.

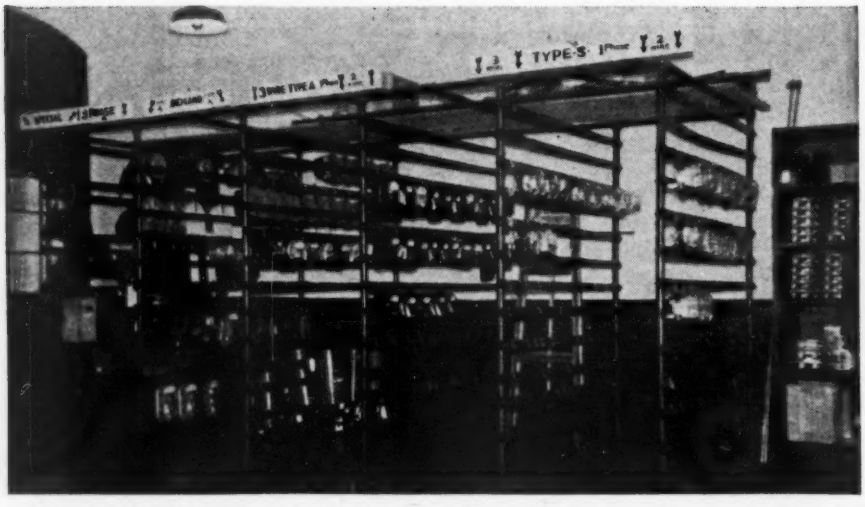
Consensus at this time between management and the contractors is that construction costs for both types of crews can be brought into line in the future through a mutual effort of field superintendents of the company and the contractor to work together in improving crew efficiencies and construction methods.

## Trailer Frees Truck for Line Operations

LINE CREWS of the Tuscaloosa district of Alabama Power Co. save the services of a truck by use of a garage-built trailer to haul line material to and from the job. The trailer is hauled to the job, cut loose and the truck is free for other work until its trailer is ready to be hauled back to the shop.

At a cost of approximately $50 (plus tires and labor) the trailer was built from a Chevrolet rear end and a 1½-ton body purchased from a junk dealer. The trailer has a 108 x 80-in. truck bed. The running gear is a Chevrolet 1½-ton truck rear end. The frame was sawed off just in front of the rear spring. The coupling pole is 4-in. double strength pipe, and the kick stand is 4-in. double strength pipe with ⅜-in. x 9-in. disc on bottom. The kick stand swings back under the coupling pole and is held in place by a bolt.

**TRAILER is built from a truck rear-end and 1½-ton body, is hauled to job and detached, releases the motor truck for other work**



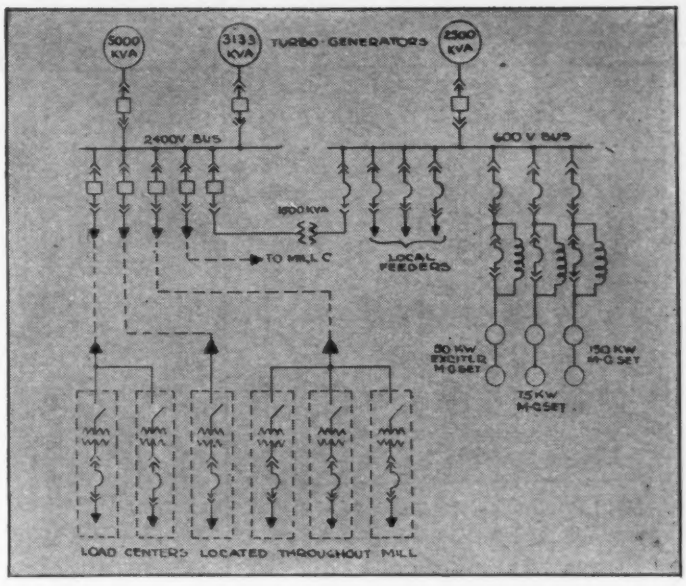
**MARKED SECTIONS of meter rack speed up storage and withdrawal of types required in service. Meters are supported by U-shaped hangers**

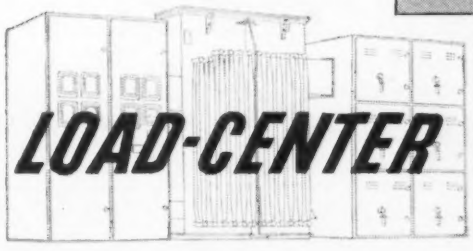
## A Labeled Meter Rack Of Simple Design

TWELVE HUNDRED watthour meters are readily stocked, when available, on a meter rack of simple design built by the Northern Berkshire Gas Co., North Adams, Mass., using pipe framing and adjustable horizontal bars of 2-in. x $\frac{3}{16}$-in. strap iron, placed 6½ in. apart on centers. Six sections with two sides each have a capacity of about 100 meters per side. Convenient signs mounted at the top of the sections show the types of meters normally carried below and save time in handling to and from stock. Meters are in general

*Switchgear and Load-center Unit Substations are Shown in this One-line Diagram.*

Originally, the 5000-kva generator was wound for 600 volts, and all but one circuit (to mill C) was powered from the 600-volt bus. The change to 2400-volt distribution brings short-circuit amperes to a value consistent with moderate-sized circuit breakers.



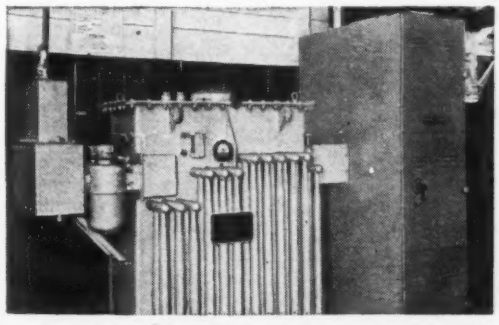
# ..BY G-E LOAD-CENTER UNIT SUBSTATIONS

• An old, inadequate plant power system was an open invitation to trouble at this mill. Electrical outages were delaying production. Circuits and switchgear which had been added piecemeal added to the danger of inadequate interrupting capacity. In spite of large secondary feeders, the distribution of 10,000 kva at 600 volts had created unsatisfactory voltage conditions.

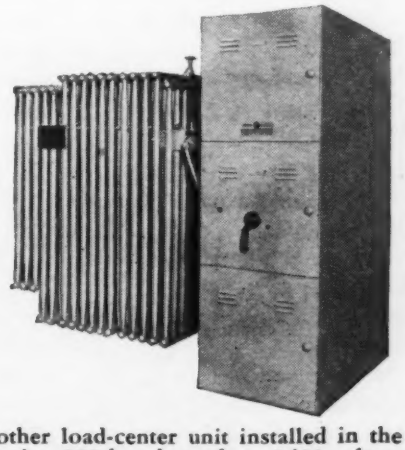
Analysis showed that further patchwork would be a costly practice. A new power distribution system, based on the use of G-E unit substations, was planned with the help of G-E engineers.

Now primary distribution is made at 2400 volts over cable that keeps voltage drop down, though it's modest in size. The powerhouse switchgear is all G-E metal-clad, equipped with magne-blast oil-less air circuit breakers. At load-center locations throughout the plant, six unit substations are installed, to step down from 2400 volts to 600. Individual circuits are fully protected by convenient metal-enclosed drawout air circuit breakers that are an integral part of the unit substation.

This new protection against outages and obsolescence is already justifying itself in power continuity and lowered costs. Why not determine, without obligation, if power-system replacement could do as much for you? Just call your local G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

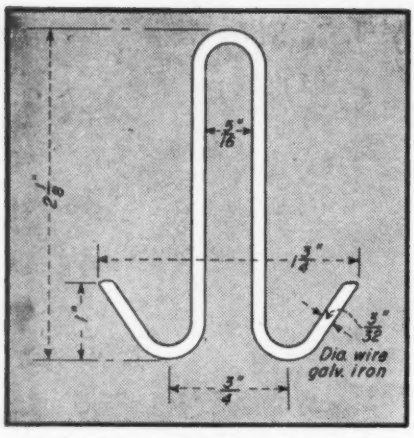


Typical load-center unit substation, as installed at locations which permit short low-voltage feeders to points of power use.



Another load-center unit installed in the mill, stepping 500-kva down from 2400 volts to 600. Draw-out air circuit breakers are co-ordinated with substation size to give full short-circuit protection without excess breaker size. Substation transformers use Pyranol non-inflammable insulating liquid.

**LOAD-CENTER POWER DISTRIBUTION UNITS**

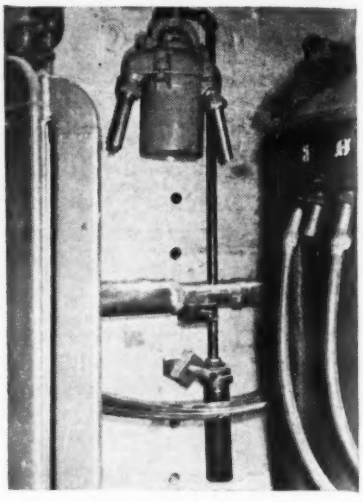



**SIMPLE 2-pronged hook made by bending 3/32-in. diameter galvanized iron wire into shape**

supported on the rack bars by U-shaped hangers with double bends at one end, as shown. These hangers are made of $\frac{3}{32}$-in. galvanized iron wire cut off in 7-in. lengths.

## Submersible Vent For Vault Cutouts

As HIGH-WATER protection for D&W cutouts installed in underground vaults, Northwestern Electric Co., Portland, Ore., extends the cutout vent in the manner shown. By providing $\frac{3}{4}$-in. vent piping terminating in a 2-in. bell near the floor it is impossible for water to rise against the trapped air and get into the cutout. The idea is not new or novel, but it appears that many utility underground engineers haven't thought of its application as high-water protection for cutouts or other devices subject to submersion.



**AIR trapped in this vent extension prevents water from damaging underground oil-filled cutout**

• • •

# Bus Appearance Favored by Streamlined Connectors

**D. L. GREENE**
Consulting Engineer
Gilbert Associates, Inc., Reading, Pa.

Use of I.P.S. tubing for bus necessitates the use of a number of various type connectors. Where a tap or "T" connection is required, a split type of connector is necessary, requiring the use of bolts. It has also been the practice in the past to use bolted type connectors for the straight connections which, on larger tubing, become quite sizable.

Use of cone compression type of connectors reduces the bulkiness of the straight connectors, which improves the appearance of bus and overcomes, to some extent, the appearance of so many connectors. Good substation design should eliminate as many connectors as possible; however, a certain number are required, and comment is often heard regarding the number of connectors used. The cone compression, straight 90-deg. connector is streamlined by the use of a jam nut on each end, and being only slightly larger than the conductor itself, lends itself very nicely to improving the over-all appearance.

The cone compression principle has been used many years for cable and has proven very satisfactory, particularly on the smaller sizes. There has been some objection to their use on larger cables having multiple layers of strand, due to the "barreling" effect; however, this objection is used to an advantage on the I.P.S. tubing.

Care must be taken in the installation of these connectors to insure a tight connection between each cone and the tubing. Butting the two pieces of tubing before tightening the second jam would not permit the second joint to become tight, as the tubing must move into the connector with the cone. The completed connection, however, should be better than the bolted type of connector because of the pressure applied concentrically on the tube.

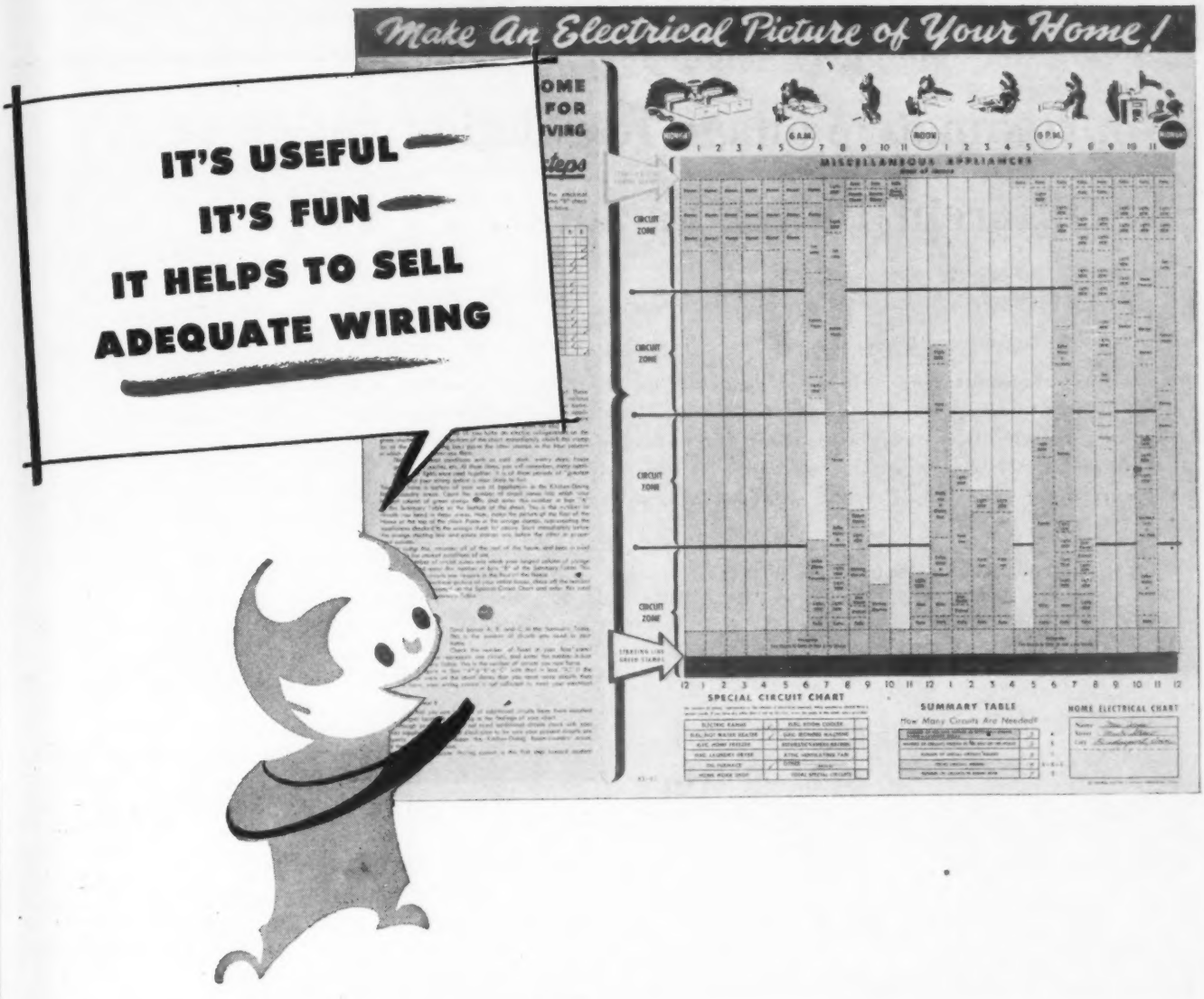
In the application of bolted type connectors, often too much pressure is applied to the bolts, which distorts the connector and leaves contact only at a few points along the tubing. Most present day bolted type straight connectors are made with heavy "ears" or bosses using a minimum $\frac{1}{2}$-in. bolt size which, if applied with the correct amount of tension on the bolt, provides a very satisfactory connection.

Thomas & Betts cone compression-type connectors were used on the Lenox substation* of the Northern Pennsylvania Power Co.'s system wherever straight connectors were required, such as the main and transformer buses and end taps to equipment. The main and transformer buses are $1\frac{1}{4}$-in. I.P.S. copper tubing mounted on O.B. No. 36318 station posts with R & I.E. Co. type P bus support clamps.

The Lenox substation is located a few miles north of Nicholson, Pa., and directly in line with the Binghamton-Scranton 110-kv. transmission line. The 110-kv. line is sectionalized at this point with Elpeco type 190 air break switches and a tap made to four 2,500-kva., 110/33-kv. single-phase transformers through S. & C. type SMG fuses. The 110-kv. bus is installed with Gilbert Associates, Inc., standard unit type structures providing facilities for the two present lines and two future 110-kv. circuits.

The 33-kv. structure is the 6-in. H-column type using 6- by 4-in. beams and 6-in. channel trusses providing for two 33-kv. circuits, grounding transformer, transformer bus and metering. Provisions were made to facilitate the installation of an unlimited number of future 33-kv. circuits by the addition of duplicate bays of steel and bus work.

* See ELECTRICAL WORLD, October 26, 1946, page 79.

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Who could resist a game that's such fun to play? What could be more interesting for homeowners than finding out for themselves about one of the most essential requirements of comfortable living—the electrical sufficiency of their own homes?

General Electric's new Home Chart gives your customers the tools to do just that. Three easy steps and—presto—they have an exact picture of what they need to make life more enjoyable—electrically. The chart is not limited to part of the story . . . it covers every hour of the day, allows for both present and future equipment. Everything is furnished—chart, printed gummed stamps, and instructions.

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Send for a copy of the Home Chart, today. We know you will want to fit it into your future load building plans.

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# Approximate Voltage Regulation At Different Power Factors . . . I*

K. M. LOVEWELL, *Engineer, Potomac Electric Power Co., Washington, D. C.*

**A method of calculating voltage regulation on short transmission lines by use of simple tables is outlined here. It has the advantage that in problems involving more than one voltage, the reference of actual ohms of resistance and reactance at one voltage to the other voltage to get everything on the same basis is avoided**

REGULATION OBTAINED is in percent of the sending voltage or no-load receiving voltage. To find it in percent of the full-load receiving voltage, which is more conventional, the percent regulation must be divided by the difference between itself and 100 percent. For example, 20 percent drop leaves 80 percent receiver voltage. This is 20 ÷ 80 or 25 percent of the full-load receiver voltage.

It should also be remembered that line loadings almost never go to zero. Therefore, regulation is never as much as no-load to full-load calculations give. If the minimum load is 30 percent the regulation will be 70 percent of the no-load to full-load calculation.

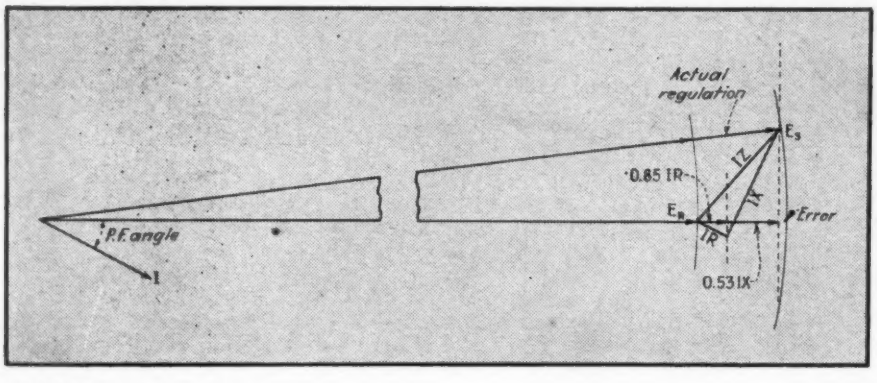
In setting up the tables some very close approximations are used, the first one being that the regulation equals the cosine of the power factor angle times the IR drop plus the sine of the power factor angle times the IX drop. This assumption is very accurate at moderate power factor and percent impedance but is not very close above 0.9 p.f. and 20 percent impedance. The lower the power factor the higher the allowable impedance for accuracy, and vice versa. The illustration shows the error at about 10 percent impedance and 0.85 p.f.

It is obvious that the error, which is the difference between the length of $E_s$ and its horizontal projection, is negligible in this case.

Table 1 lists several different sizes of 3-phase cables and overhead conductors found on power systems. The percent impedance per mile is shown for each on its own nominal kva. rating. This is to provide figures for ratioing the unit values found in Table 2 to actual conditions of load and distance as shown below.

The ratio of X to R is also included in Table 1 as this affects the regulation considerably.

The ohms were taken from standard tables of copper conductors. Resistances at 25 deg. C. were used for overhead wire and 65 deg. C. for cable. Cable reactances are for solid type H cable at 13.8 kv. and oil-filled type H at 34.5 and 69 kv. Overhead wire reactances are at 2.3-ft. spacing for 13.8 kv., 5.8-ft. for 34.5 kv. and 10-ft. for 69 kv.



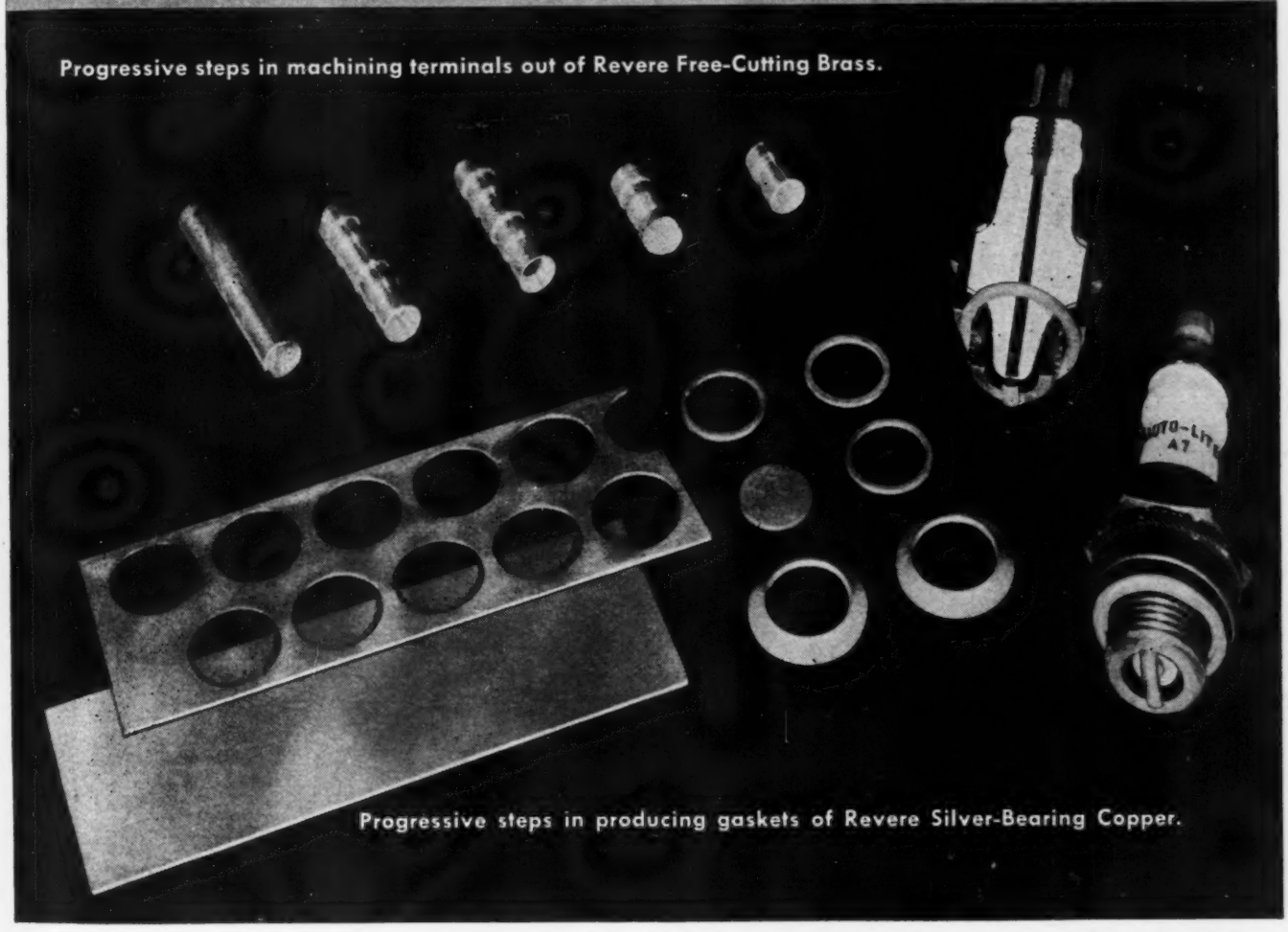

**ERROR in regulation**

**TABLE I**
**Impedance of Various Sizes of Copper Conductors**

| CONDUCTOR | IMPEDANCE OHMS PER MILE | IMPEDANCE PERCENT PER MILE | RATIO X/R |
|---|---|---|---|
| 13.8-kv., 3-phase cable | | | |
| 500 M cir mil | 0.13 + *j* 0.16 = 0.21 | 0.88 on 8,000 kva. | 1.2 |
| 350 M cir. mil | 0.19 + *j* 0.17 = 0.26 | 0.82 on 6,000 kva. | 0.9 |
| 4/0 | 0.31 + *j* 0.18 = 0.36 | 0.85 on 4,500 kva. | 0.6 |
| 1/0 | 0.62 + *j* 0.20 = 0.65 | 0.99 on 2,900 kva. | 0.3 |
| 13.8-kv. O.H. | | | |
| 4/0 | 0.28 + *j* 0.60 = 0.66 | 3.5 on 10,000 kva. | 2.1 |
| 2/0 | 0.44 + *j* 0.63 = 0.77 | 3.2 on 8,000 kva. | 1.4 |
| 1/0 | 0.56 + *j* 0.64 = 0.85 | 3.5 on 7,000 kva. | 1.1 |
| 34.5-kv., 3-phase cable | | | |
| 500 M cir. mil | 0.13 + *j* 0.15 = 0.20 | 0.34 on 20,000 kva. | 1.2 |
| 350 M cir. mil | 0.19 + *j* 0.16 = 0.25 | 0.32 on 15,000 kva. | 0.8 |
| 4/0 | 0.31 + *j* 0.17 = 0.35 | 0.32 on 11,000 kva. | 0.5 |
| 34.5-kv. O.H. | | | |
| 4/0 | 0.28 + *j* 0.71 = 0.76 | 1.9 on 29,000 kva. | 2.5 |
| 2/0 | 0.44 + *j* 0.75 = 0.87 | 1.6 on 22,000 kva. | 1.7 |
| 1/0 | 0.56 + *j* 0.76 = 0.94 | 1.5 on 19,000 kva. | 1.4 |
| 69-kv., 3-phase cable | | | |
| 500 M cir. mil | 0.13 + *j* 0.18 = 0.22 | 0.21 on 45,000 kva. | 1.4 |
| 350 M cir. mil | 0.19 + *j* 0.19 = 0.27 | 0.19 on 34,000 kva. | 1.0 |
| 4/0 | 0.31 + *j* 0.20 = 0.37 | 0.19 on 25,000 kva. | 0.6 |
| 69-kv. O.H. | | | |
| 4/0 | 0.28 + *j* 0.78 = 0.83 | 1.0 on 57,000 kva. | 2.8 |
| 2/0 | 0.44 + *j* 0.82 = 0.93 | 0.84 on 43,000 kva. | 1.9 |
| 1/0 | 0.56 + *j* 0.83 = 1.00 | 0.78 on 37,000 kva. | 1.5 |

* Concluding part to be presented in an ensuing issue.

# SPARK PLUG ILLUSTRATES VALUE OF CAREFUL SELECTION AMONG REVERE METALS


Progressive steps in machining terminals out of Revere Free-Cutting Brass.
Progressive steps in producing gaskets of Revere Silver-Bearing Copper.

THE automobile industry, an important Revere customer, is noted for the extreme care it uses in selecting among the many Revere Metals. This careful selection assures speed and economy in manufacture, and protects reliability of operation in the hands of the ultimate user.

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Gaskets, three to each plug, are punched and formed out of Revere Silver-Bearing Copper. This metal was chosen in order to prevent annealing during operation, thus retaining the spring tension which is necessary to prevent leakage or "blow-by" past the gaskets.

Revere Metals include: *Copper and Copper Alloys:* Sheet and Plate, Roll and Strip, Rod and Bar, Tube and Pipe, Extruded Shapes, Forgings; *Aluminum Alloys:* Tube, Extruded Shapes, Forgings; *Magnesium Alloys:* Sheet and Plate, Rod and Bar, Tube, Extruded Shapes, Forgings; *Steel:* Electric Welded Steel Tube.

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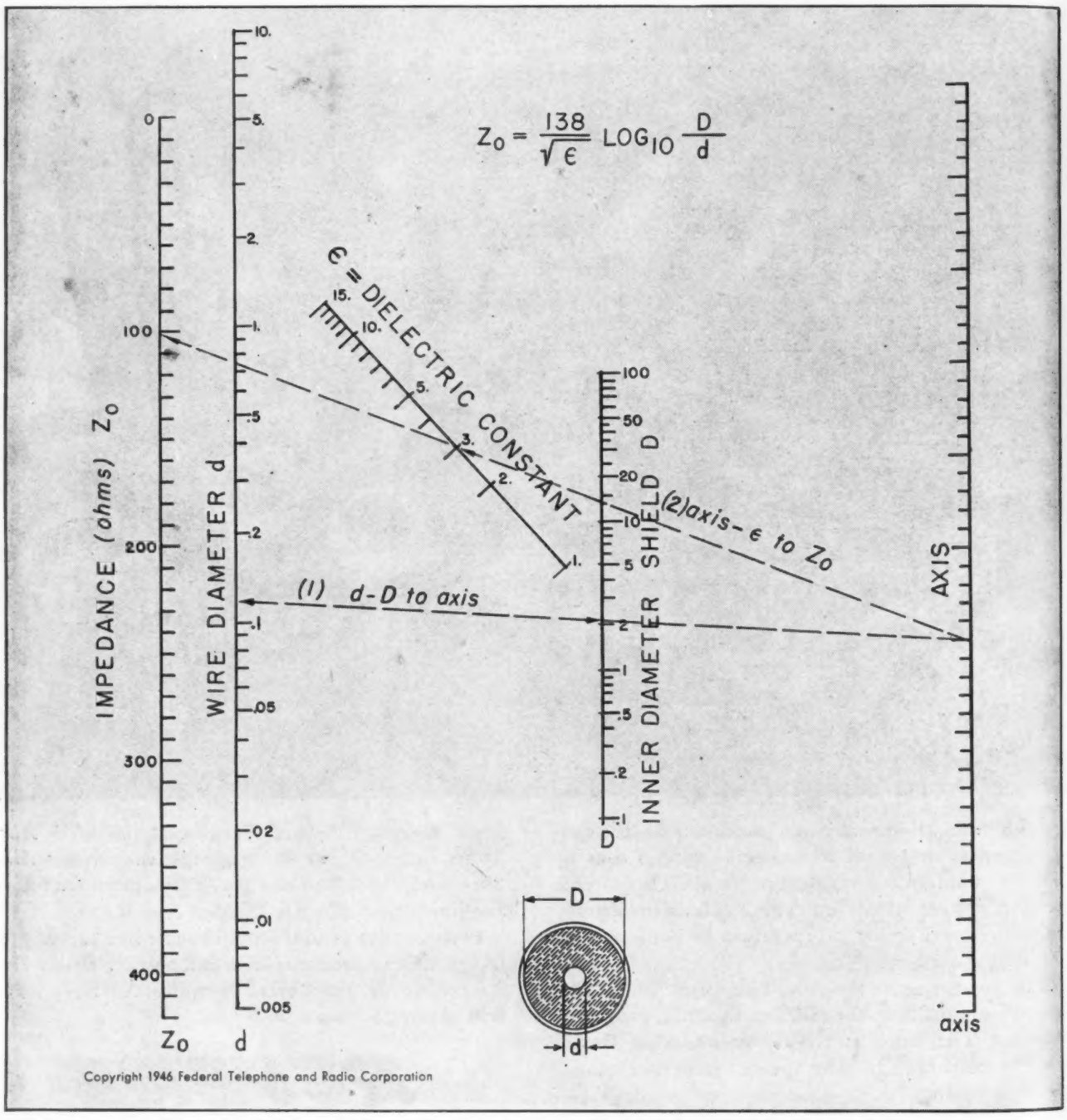
# Characteristic Impedance of Lines*

## III—*Concentric Line, Solid Dielectric*

KARL ZIMMERMAN, *Engineer, Intelin Division, Federal Telephone & Radio Corp., New York, N. Y.*

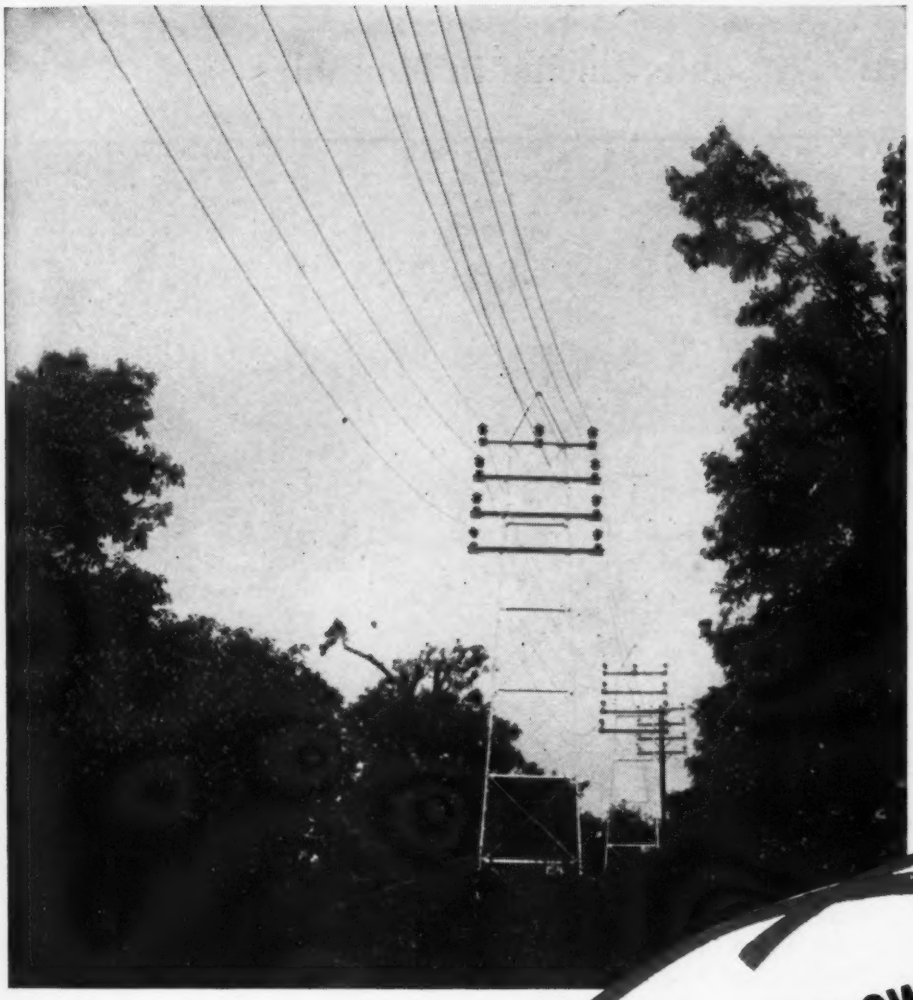



THIS CHART gives theoretically exact values for any scale of dimensions, if lossless dielectric is assumed (filling completely the space between conductors), and perfect conductors. Line from d and D scales extends to the axis. From latter point a line through ϵ scale will intersect $Z_0$ scale at resulting value.

Example:

d = 0.12 cm. D = 2.1 cm. ϵ = 3.0. $Z_0$ = 102 ohms.

* One of a series of five articles which began in ELECTRICAL WORLD, October 26, 1946, page 92.



# PLACE YOUR OWN VALUE ON 27 YEARS OF TROUBLE-FREE INSULATOR PERFORMANCE

TWENTY-SEVEN years ago--in 1919--these three 24 Kv. circuits were built on O-B pintype insulators. Vital loads in a large industrial city have depended upon the over-all performance of this line, and the O-B insulators have contributed their share to an outstandingly good record by no Outage Reports traceable to insulator failure . . . In buying insulators for your new construction, look ahead a quarter-century or more and assign your own value to insulators that will still be giving faultless performance. Proved reliability is yours for the asking. Build with O-B insulation!

*Ohio Brass*

MANSFIELD, OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LT'D
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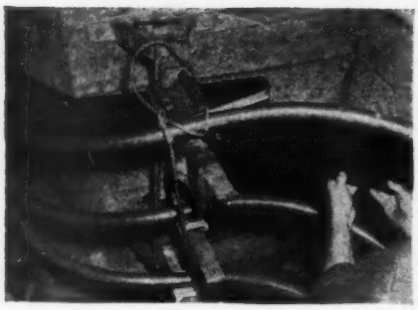
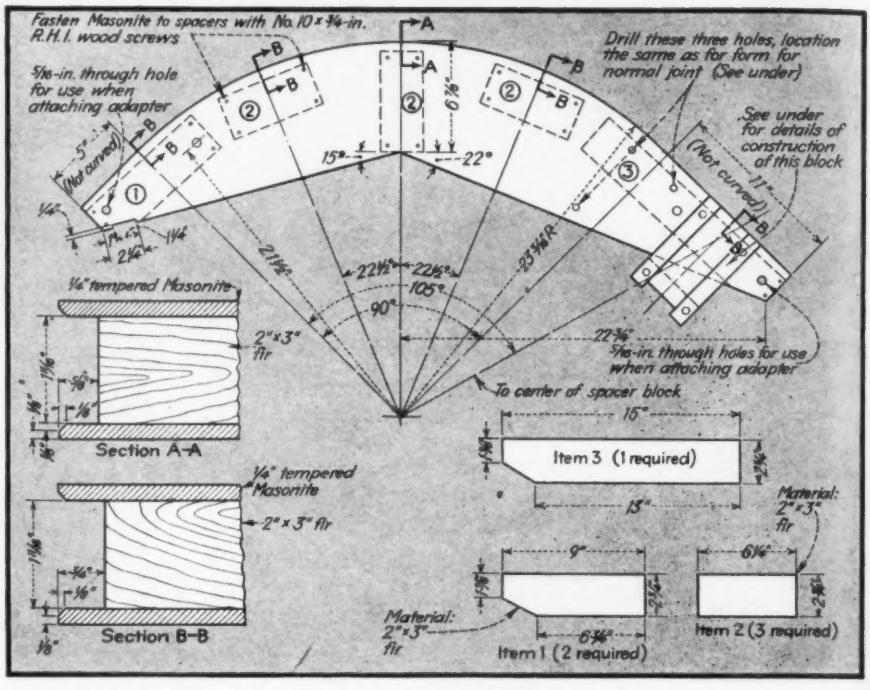
HEADQUARTERS FOR PORCELAIN INSULATION

# Templates Aid Cable Placing in Manholes



**CLOSE-UP of 110-kv. oil-filled cable racked around corners of manhole with the aid of form and template of masonite**


Fasten Masonite to spacers with No. 10 x ¾-in. R.H.I. wood screws
5/16-in. through hole for use when attaching adapter
Drill these three holes, location the same as for form for normal joint (See under)
See under for details of construction of this block
(Not curved)
15°
22°
6⅜"
21½"
22½°
105°
90°
23⅝" R
22⅜"
5/16-in. through holes for use when attaching adapter
To center of spacer block
¼" tempered Masonite
2" x 3" fir
Section A-A
Section B-B
Item 3 (1 required)
Item 2 (3 required)
Item 1 (2 required)
Material: 2" x 3" fir

**DETAILS of form for bending cable in manholes**

FORMS and templates of masonite greatly assisted in the shaping and racking of 110-kv. oil-filled cable during the construction of the new Mystic-Woburn line of the Boston Edison Co. These were used at manhole bends as shown, each cable forming one phase of the circuit. In the illustration, the form shown in the upper left was left in place during jointing. The radius of the right-hand bend is being checked by the template. The use of a standard 24-in. radius produced a 48-in. offset in normal joint manholes and a 60-in. offset in stop joint manholes, with 12 in. of straight cable run between the two bends in the stop-joint installations. The form shown at the left consists of two pieces of masonite with a spacing block between. Reversible support blocks at the cable bracket were made adjustable for both stop joint and normal joint manholes.

• • •

# Mobile Crane Handles Cable Reels

**MOBILE crane with an all-weather cab is in service in a cable yard**

LOADING a reel on a truck is one of the applications of a mobile crane operated in the East River cable yard of the Consolidated Edison Co. of New York, Inc. Use of the swing-boom vehicle supersedes the former method of using skids and the truck winch to pull the reels up onto the truck or other more cumbersome hoisting methods. This time-saving operation greatly facilitates the hoisting of cable in the yard and assures the delivery of cable on schedule to the pulling crews in the field.

As shown in the illustration, cable reels having a 7-ft. diameter and weighing up to 6½ tons are handled by the crane. The boom has a 22-ft. length and 180-deg. swing. This single-operator mobile unit, a product of Silent Hoist Winch & Crane Co. of

# Elevation 13,500 feet...

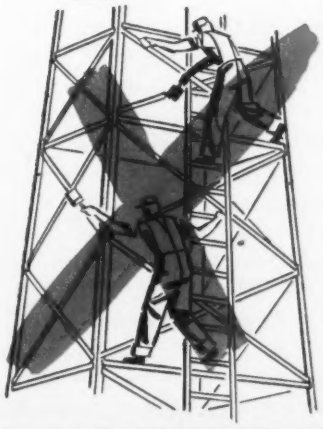
## AND TOUGH GOING TO GET THERE . . . WOULD BE A "NATURAL" FOR TOWERS OF ALCOA ALUMINUM

The lighter weight of Alcoa Aluminum structural shapes greatly simplifies the transportation of materials to sites like this. It makes erection easier, too—facts well worth remembering when you're designing towers for out-of-the-way places.

Even if you don't have a right-of-way over this kind of country, there's another way Alcoa Aluminum can simplify your operation.

Aluminum is highly resistant to corrosive attack; it normally needs no protective painting. Use Alcoa Aluminum structural shapes, therefore, in the upper portions of your towers and eliminate the need for costly and hazardous painting.

Designers and operating men interested in this idea may obtain full data on Alcoa Aluminum structural shapes through the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

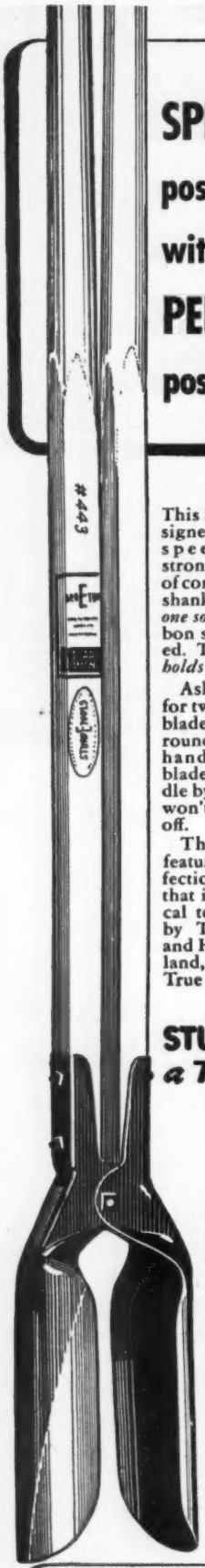


*Aluminum normally needs no protective painting.*

**ALCOA** FIRST IN **ALUMINUM**

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM




**SPEED**
**post digging**
**with this**
**PERFECTION**
**post hole digger**

This SturdE digger is designed and engineered for speed—built by the strongest known method of construction. Blade and shank are forged from *one solid piece* of high carbon steel, then heat treated. The blade takes and *holds* a keen cutting edge.

Ash handles are square for two to three feet above blade. Then, tapered and rounded to give a firm, hand-fitting grip. The blade is attached to handle by hardened bolts that won't crystallize and shear off.

These special SturdE features give you a Perfection Post Hole Digger that is easy and economical to use. Manufactured by The American Fork and Hoe Company, Cleveland, Ohio, Makers of True Temper Products.

**STURDETOOLS**
*a* **TRUE TEMPER PRODUCT**

*Tapered blade is 12 in. deep by 7 in. wide, forged from one solid piece of high carbon steel. Made in regular and heavy duty lengths. No seams, no joints, no welds to weaken and fail. Ash handles (7 and 8 ft.) sanded and lacquered, have a 34 in. span when open, carry foot marks to show depth of hole.*

*Distributed by*
**JOSLYN MFG. & SUPPLY COMPANY**
**20 North Wacker Drive • Chicago, Illinois**
*Branches and Warehouses with Complete Stocks in Principal Cities of the United States*


Brooklyn, is powered by an internal combustion engine for loading and unloading operations and for transportation at speeds up to 10 mph.

•

## Inspecting Distribution Transformers

PERIODIC INSPECTION of distribution transformers, their repair and replacement on an eastern power system are the immediate responsibility of a maintenance supervisor. Overhead transformers on poles are inspected by a line inspector and helper annually between November 15 and January 1. Transformers located on the ground may be inspected by these employees or by a maintenance man and helper; those over 100 kva. by a transformer repair man and maintenance man; and subway type transformers in vaults or manholes by the above repair man aided by a cable splicer. All transformers except those examined by the line inspector are inspected yearly between April 1 and October 1. The making out of inspection orders starts about March 15 at the hands of the maintenance supervisor.

Overhead transformer inspection routine (briefed) follows:

(1) Check inspection order for correct location by municipality, street and pole number.
(2) Climb pole and test case to see if it is alive to ground, using detector provided.
(3) Copy nameplate data; note paint condition, particularly with steel case.
(4) Examine case for cracks, oil leaks, and for siphoning of oil by leads.
(5) Loosen bolts on transformer cover.
(6) Make certain no power customers are on transformer, but if so, arrange if possible for a few minutes' service cutoff.
(7) Kill transformer. Inspect primary fuses, carriers, connection, etc., renewing fuses if necessary.
(8) Remove cover; note if there is odor of burned insulation or other indication of overload or lightning damage.
(9) Test for water in the oil by sampler. Collect oil in bright metal container and check for presence of water globules at bottom. Note presence of any sludge.
(10) Examine gasket under cover for condition. Renew if need be.
(11) Check oil level, adding if necessary from 1-gal. demijohn protected by fiber and provided with rope sling to draw it up pole. If complete change of oil is necessary, remove transformer to repair department.
(12) Inspect primary and secondary leads and bushings inside and outside transformer. If insulation is poor with danger of breakdown to case, or if bushings are badly cracked or broken, report transformer for change, making sure leads do not touch the case inside the transformer.
(13) Examine all primary taps and transformer connections including terminal board, if any, making sure none are loose.
(14) Replace cover, allowing bolts to remain loose. Make transformer alive. If gasket is to remain, tighten bolts on cover, making sure none are missing.
(15) Examine all ground wires and secondary taps for tightness.
(16) Examine hanging, noting tightness of bolts, condition of crossarms, verticality of transformer, and any other condition liable to cause trouble.
(17) Examine lightning arresters on poles and note any visible defects.
(18) Report any other defects not covered above, in transformer or its surroundings.

Inspection of subway type transformers follows above practice in general.

Defects in lead cables are to be noted and special efforts made to secure watertight job in replacing covers.

Substation transformers are inspected for loose connections, damaged bushings and other visible defects when meggered. Repair man collects oil sample from transformer (drawing off standing oil in pipe or nipple between transformer bank and drain valve before taking sample representing interior condition). Maintenance supervisor examines samples and meter department tests for breakdown. If sample shows much sediment on settling or breakdown occurs below 20 kv., the transformer oil is filtered and must show a satisfactory breakdown test before replacement. Manufacturers' instructions are followed in sampling and testing Inerteen or Pyranol. Network transformers are inspected monthly under special routine. Transil oil, Inerteen and Pyranol are sampled and tested annually.

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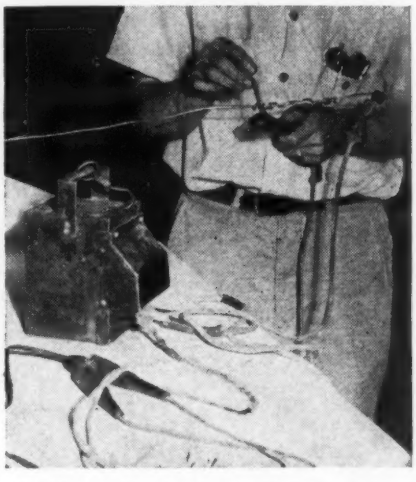
## Electric Soldering Best for Services


**R. J. McKNIGHT**
Central Arizona Light & Power Co.
Phoenix

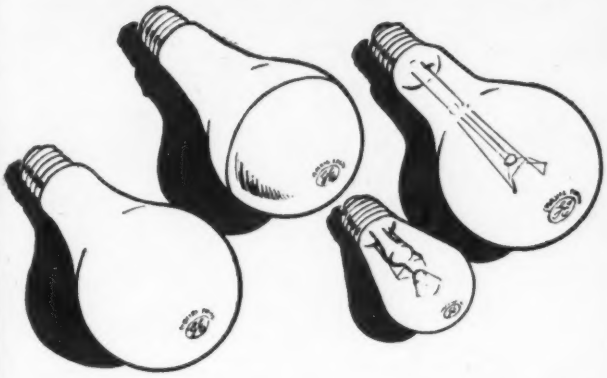
**HEAT for soldering joint is generated in few seconds by passage of 60-70 amp. through carbon electrode supplied from 120/9-volt transformer**

OF ALL the methods used for soldering services in the field, Central Arizona Light & Power Co. likes best the electric heating method shown. Heat is generated in the joint to be soldered by current from a low-voltage transformer applied through a carbon electrode. The home-made transformer consists of a core approximately 1½-in. square made from salvaged potential transformer laminations, with 480 turns of No. 16 wire on the primary and 36 turns of No. 6 wire on the secondary. This develops 60 to 70 amp. in the joint to be soldered and raises the wire to soldering temperature in a matter of 15 or 20 sec. for a joint in No. 4 wire. Primary leads are clipped to the energized service wires to feed the transformer.

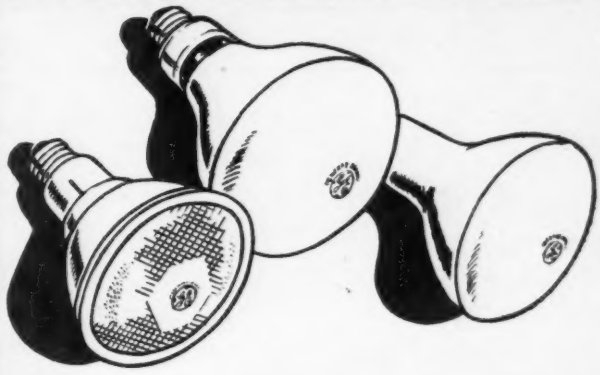
This method is preferred to a blow torch or acetylene tank because it is

# lamps you need...

# MAKES 'EM ALL!



**G-E Filament Lamps** for general lighting jobs are made in sizes from 6 to 1500 watts; candelabra, intermediate, medium or mogul screw bases, or bi-post base in certain sizes. Standard lamps operate on 115, 120 and 125 volt circuits. Others made for 230 and 250 volt circuits and for low-voltage farm service.



**G-E Reflector and Projector Lamps** offer a wide selection of concentrated and wide-spread floodlighting beams. Reflector spot lamps are widely used to highlight store displays. Reflector flood lamps are ideal for overall emphasis lighting. Both serve similarly in outdoor uses, such as safety lighting in plant yards.

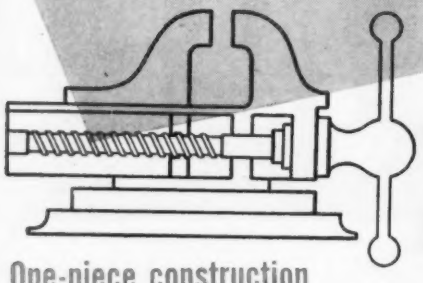
**No Lighting Job** can be better than its lamps. You can depend on the quality of G-E lamps for every use — home, commercial and industrial. Whatever your interest in lighting, look to General Electric for the most advanced developments in lamps, because G-E Lamp research is constantly at work with one idea in mind—to make G-E lamps *Stay Brighter Longer!*

## G-E LAMPS

*Stay Brighter Longer!*

GENERAL ELECTRIC

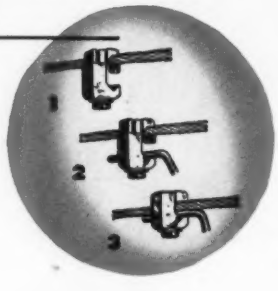
FARGO Connectors
go on fast . . .
and stay on tight



Built like a vise . . .
grips like a vise!

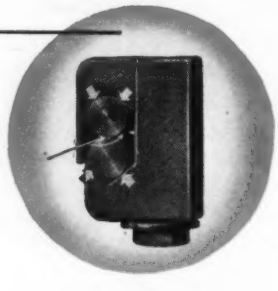
One-piece construction

One bolt to tighten—always engaged—no time lost starting a nut—no chance of cross threading—no loose parts to lose.



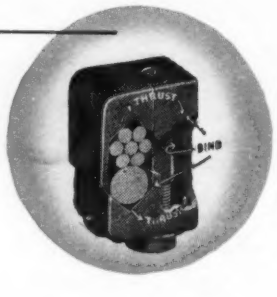

High Pressure at wire contact

Inside thrust action against the vise-type sleeve of the connector results in the vibration-proof bind of the Fargo Connector.



Vibration-proof bind

Every inch-pound of wrench pressure develops 10 lbs. or more compression between conductors, resulting in high conductivity. The V-Groove jaw guarantees four points of contact with conductors.




*Fargo special metals and design also mean high salvage value.*

There are 12 sizes of Fargo Solderless Connectors for wires from No. 8 solid to 1000MCM.

Full Fargo line distributed by
LINE MATERIAL COMPANY, MILWAUKEE, WISCONSIN
*(Representatives in principal cities)*

FARGO
ESTABLISHED 1914
MFG. COMPANY, INC.
Poughkeepsie, N. Y.

quick, the joint to be soldered is clean and uncontaminated and there is no bother with flame torches, too often running out of fuel.

•

## Annealing Glass Piping Electrically

B. W. WHITEHURST
Engineer
Stone & Webster Engineering Corp.
Boston, Mass

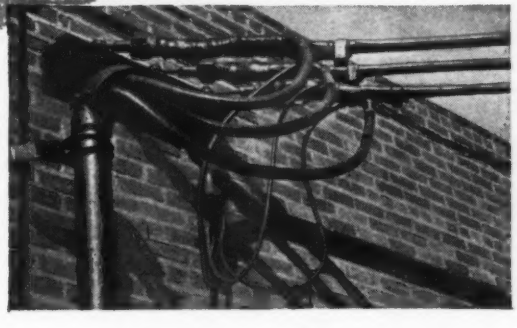
**APPLICATION of annealing furnace to bending an offset in Pyrex pipe on Manhattan Project at Oak Ridge, Tenn.**

FROM PRACTICES developed by the Stone & Webster Engineering Corp. at the Clinton Engineer Works, Oak Ridge, Tenn., in connection with the Manhattan Project, with the cooperation of the Corning Glass Works, greatly improved means of handling borosilicate (Pyrex here) glass tubing have become available. In most cases, stress relieving or annealing of glass pipe is a simple procedure, but close attention to details is required. Should pipe be allowed after sealing to cool directly to room temperature, it may soon break apart at the seal line. This annealing is done by heating the seal and the adjacent areas two or more inches beyond each side of the seal in an electric furnace to a temperature just high enough to relieve the strains without deforming the pipe, and for a period of 6 to 12 min. Pipe sizes of 2-in. diameter and under required a 300-watt furnace energized 6 to 8 min. and held with current off at least 3 min. before removing for 1-in. pipe; 8 to 10 min. energized, and at least 4 min. held in place deenergized for

# FOR WEATHER-PROOF, ABRASION RESISTANT WRAPPINGS USE

# Fibron

## PLASTIC TAPE



Unprotected wrappings of Fibron Plastic Tape have insulated the tap splices at the weatherhead illustrated since May 1945. Exposed to the severe seasonal changes and the corrosive atmosphere of Northern New Jersey, these wrappings are as sound as ever and have indefinite future life.

Proved durability plus good dielectric and tensile strength demonstrate why black or transparent Fibron Tape offers outstanding advantages for wrapping overhead service connections. Its unusual elasticity permits neat, tight wrappings. Instant heat sealing bonds the ends.

**FOR UNDERGROUND SERVICE:** Having good resistance to moisture, grease, oils, corrosive fumes and abrasion, this tough yet flexible insulation is a "natural" for wrapping joints on secondary wiring. No compounds or other materials needed.

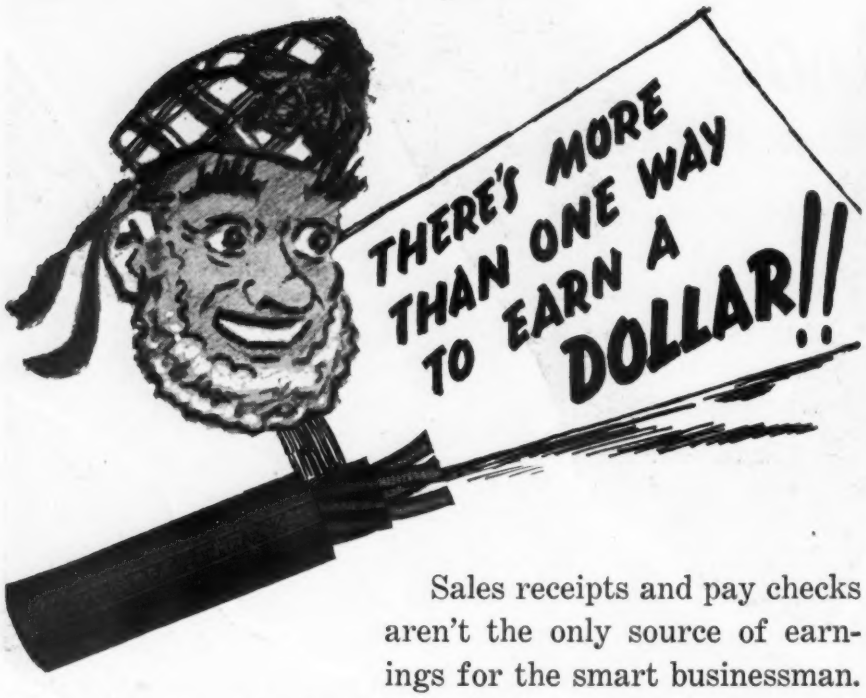
For these and other problems where long-lived insulation is required, investigate Fibron Plastic Tape.

**OUTSTANDING PROPERTIES OF FIBRON PLASTIC TAPES**

| | #1 Black | #3 Transparent |
|---|---|---|
| Thicknesses | .008" .012" .020" | .020" |
| Widths | ½" to 3" | ½" to 3" |
| Dielectric Strength (.012" tape) | 1000 VPM | 750 VPM |
| Tensile Strength, lb. per sq. in. (dumbell specimen tested) | 1600 | 1600 |
| Elongation | 250% to 400% | 350% |
| Brittleness Temperature | −41 deg. C. | −38 deg. C. |
| Bonding Temperature (depending on method used) | 130°-150°C. | 135°-155°C. |
| Specific Gravity | 1.25 | 1.22 |

IRVINGTON *Varnish and Insulator Company*

IRVINGTON 11, NEW JERSEY, U.S.A.




Sales receipts and pay checks aren't the only source of earnings for the smart businessman. When it comes to buying electric cords and cables he knows that wise purchasing is earning power too, for by demanding TIREX he saves many important dollars that would otherwise be spent for repairs and eventual replacements.

Simplex-TIREX Cords and Cables are the products of skilled engineering and are designed to give dependable service even under the most adverse operating conditions.

Finely stranded conductors provide the flexibility required wherever portable cables are used, and they are insulated with a compound having adequate electrical properties and lasting mechanical strength.

The outer jacket of Selenium Neoprene Armor, reinforced by a hard-twisted seine twine braid, assures resistance to sunlight, oil, flame and abrasives to a degree unsurpassed by any other cable.

Add up the features TIREX offers and you'll find they add up to long-run savings for you. That's why the economy-wise specify Simplex-TIREX Cords and Cables when ordering.

TIREX
SELENIUM
Neoprene Armor

Simplex-WIRES & CABLES

SIMPLEX WIRE & CABLE CO. 79 SIDNEY ST. CAMBRIDGE 39, MASS.

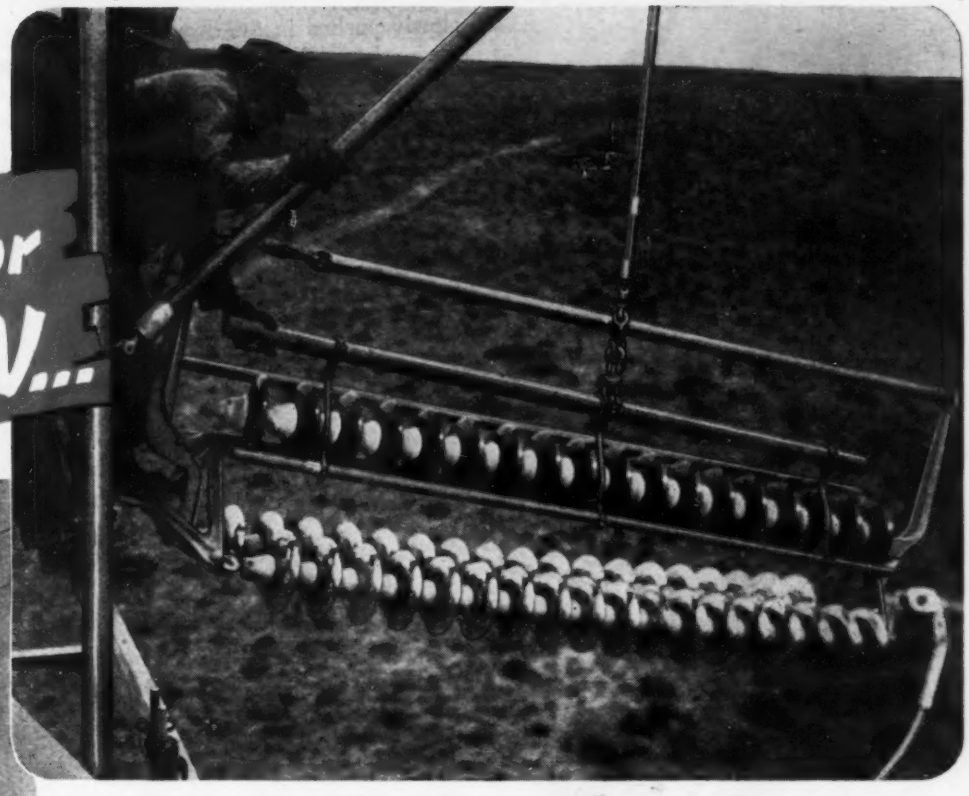
1.5-in. pipe; and energized 9 to 12 min., followed by a minimum of 5 min. deenergized time before removal, for 2-in. pipe.

Borosilicate glass pipe 3 and 4 in. in diameter called for a larger diameter annealer and from 300 to 600 watts for proper heat transfer. The procedure for annealing is the same as for 2-in. and smaller pipe, but with the 4-in. annealer more uniform heat distribution is gained by rotating the larger pipes axially on 15-in. runs, every minute on 10-in. runs, and when off 5 min. before removing, rotating 90 deg. every 15 sec. A temperature of around 500 deg. C. is required for annealing thick-walled pipe, and the cooling rate should not exceed 25 to 35 deg. C. per min. Average thick-wall glass piping requires about 15-min. cooling period. Polariscope tests are necessary to check absence of strains.

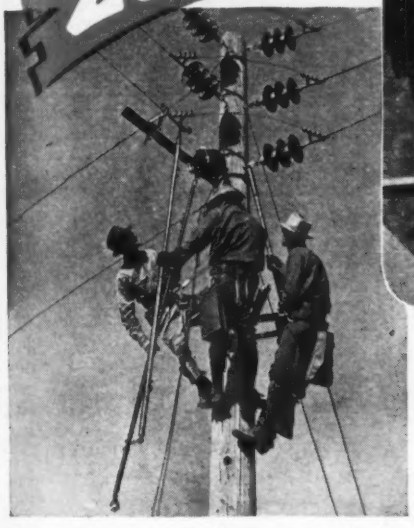
***Annealing During Installation***

Many special pipe details were required at Oak Ridge, involving new techniques in procedure. Bends, offsets, side outlet fittings, companion outlet pieces, eccentric and concentric reducers, crosses and manifolds were produced on a large scale. In one case a piece of flanged equipment was removed to a new location where the outlet flange was 2 in. or more out of axial alignment with the connecting tee some 5 ft. away. Also, the flanges of the tee and the equipment outlet were 8 deg. out of parallel. This piece of equipment protruded through the floor above with the equipment outlet near the ceiling, making accurate measurements difficult. Freedom from strain was imperative in the connecting piping, which was hard to achieve after the bolts were tightened in the make-up flanges.

After two attempts to fabricate a satisfactory offset piece it was decided to bend and anneal the connecting pipe in place. This was done by procuring a piece of flanged pipe slightly shorter than the distance between the flanges of the equipment and the tee, and securing this pipe rigidly to the outlet of the apparatus. The other end of this pipe was hung by a rope from the ceiling. Two 110-volt, 6-amp. electric annealing furnaces were suspended with their heating surfaces concentric with the pipe to be bent. The glass was then heated until it showed signs of softening. At this point the pipe was

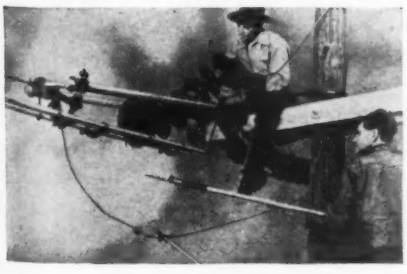


7.5 KV or 230 KV...

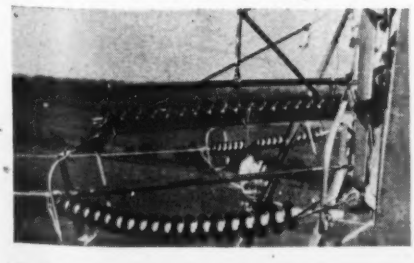


*Dead end insulators on poles or crossarms (up to 16 KV) can be changed in a matter of minutes with this handy dead end tool.*

# DEFECTIVE INSULATORS are replaced HOT with CHANCE (TIPS) TOOLS!



*For higher voltages use the above two-pole strain carrier and cradle combination for single strings. The single pole strain carrier below is made to handle double insulator strings.*



The illustration above shows how Bonneville maintenance crews quickly replace damaged insulators on the 2700-mile, high-voltage Bonneville-Grand Coulee system. One single-circuit dead end tower has six triple string insulator assemblies, or a total of eighteen strings of eighteen insulator units each. With Chance (Tips) Tools, a single crew changes all insulator strings on a tower in 12 hours actual working time.

Whether *your* line maintenance problem is large or small... whether you service thousands of miles of high-voltage circuits or a small rural line, Chance (Tips) Tools make it possible to replace dead end insulators without interrupting service, and with utmost simplicity and safety.

All Chance (Tips) Tools are tested to withstand 75,000 volts per foot of pole. They are available for all types of live line maintenance.

C4613

**A·B·CHANCE CO·**
**CENTRALIA, MISSOURI.**
**SAN FRANCISCO, CALIFORNIA**

ABC INDUSTRIES

SUPERIOR

...means *top quality* laboratory equipment, enclosures, test tables, switches, reactiformers and other electrical products built for industry by skilled workers in Superior's own plant.

SUPERIOR SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO

A SUBSIDIARY OF THE UNION METAL MANUFACTURING COMPANY

slowly pushed in the direction of the tee outlet until the flanges were axially aligned. Ring closures were placed, gaskets inserted, and bolts slowly drawn up. This stretched the piping until the flange faces were in intimate contact. The current in the furnaces was then cut off and the pipe allowed to cool with the annealing furnaces still suspended from the ceiling and surrounding the pipe, in order to keep off drafts. After the furnaces were removed, the connecting piece was examined with the polariscope and it was found to be free from strains.

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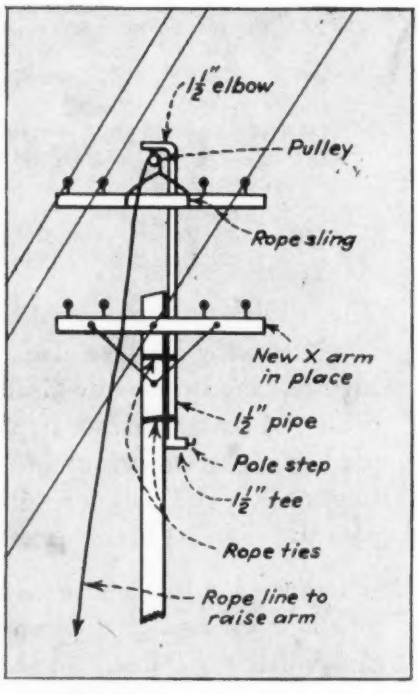
## Pipe Gin Used For Replacing Crossarms

M. L. MONSON

Supt., Fosston (Minn.) Municipal Light & Power




**TEMPORARY pole-top extension for exchanging arms**

THE ACCOMPANYING SKETCH shows a method which we use to replace old crossarms. The gin pole is made out of 1½-in. galvanized pipe with a tee to support the load on a pole step. An elbow with a short piece of pipe is fastened to the top end. The gin pole is 8 ft. long and the short horizontal piece on the top is 1 ft. long. A loop is welded in the short piece to fasten a pulley. The gin pole is held secure to the pole by means of short ropes.

After the arm is replaced, the old arm is then lowered and the wires transferred from the pins of the old arm to the new arm.

This gin may also be used to raise other apparatus such as transformers.

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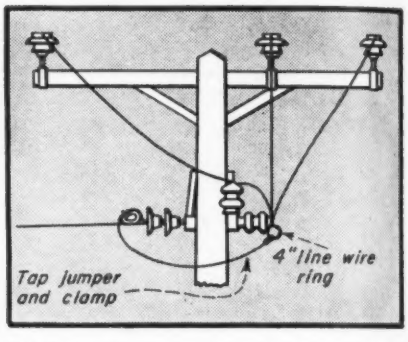
## Simple Disconnect Provided Without Switches

E. W. HATZ

Transmission Engineer
Wisconsin Electric Power Co.
Milwaukee, Wis.




**SAFE tap connection made to line wire ring on post insulator**

TAPS for small loads connected to 13.2-kv. sub-transmission circuits often do not justify the expense of air break or disconnect switches but should have some provision for removal. A simple solution is shown in the accompanying illustration.

Taps made permanently to the line conductors are carried to 4-in. line wire rings on post type insulators mounted on the buck arm position opposite the branch line take-off. The tap line wire is then dead-ended with a jumper long enough to reach the ring. A hot line clamp on the end of this jumper is connected or removed at the line ring point.

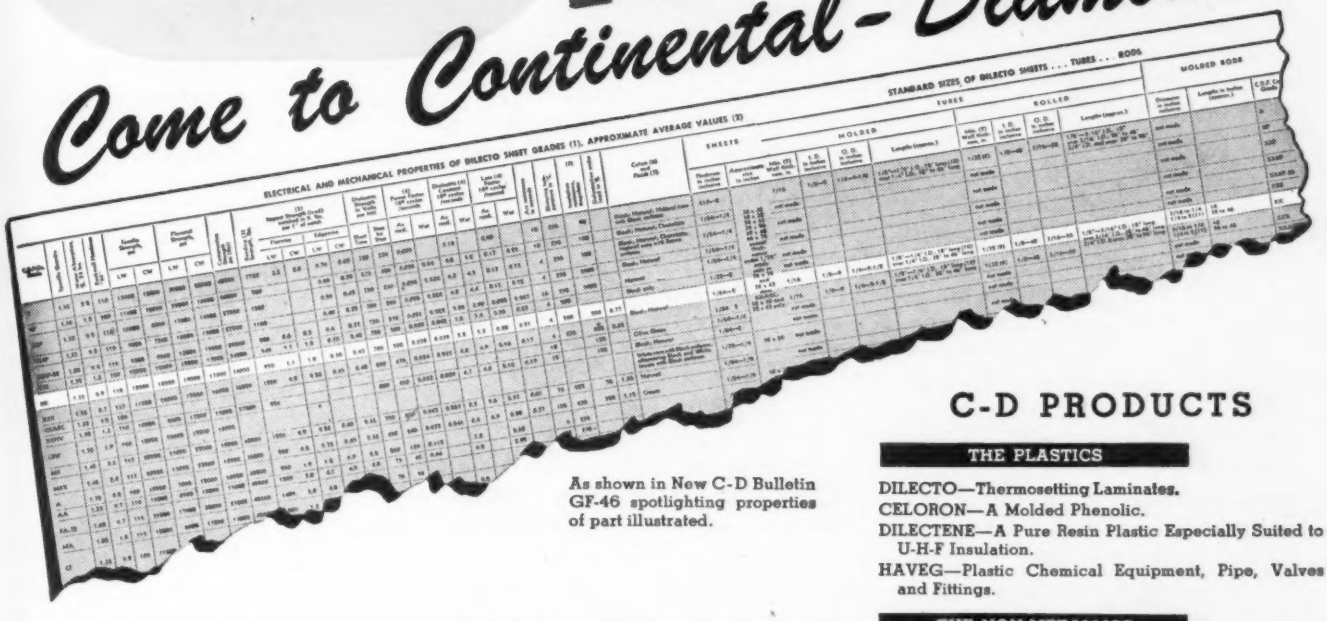
This arrangement has the advantage of bringing the connection down to the lower level and places the whole jumper connection below the main line for safer handling by the lineman.

The position of phases is fixed so that errors cannot be made in re-connecting and the rings give the further advantage of preventing line wire burning. The arrangement cannot, of course, be used where there is a high current to be dropped by the removal of the taps.

# For the "WHERE and HOW to use WHAT PLASTIC"

Paper base Grade XX Dilecto part used in electrical equipment as an insulating terminal board . . . a strong, durable laminate with high electrical insulating properties and stability under extremes of temperature and moisture conditions.

## Come to Continental-Diamond


ELECTRICAL AND MECHANICAL PROPERTIES OF DILECTO SHEET GRADES (1). APPROXIMATE AVERAGE VALUES (2)
STANDARD SIZES OF DILECTO SHEETS . . . TUBES . . . RODS

As shown in New C-D Bulletin GF-46 spotlighting properties of part illustrated.

For help in selecting and applying the non-metallic that will give you what you want in more effective insulation, let a C-D technician work it out with you. Make use of our research and engineering facilities which for half a century have kept up with the rising standards of product performance.

The right time to decide what material to use is while your product is in the planning stage . . . before blueprints and detailed specifications are completed. Save yourself costly errors in production and performance by knowing in advance the non-metallic that best meets your required electrical and physical properties.

As a starter, send for our new Bulletin GF-46 which contains engineering data on the complete line of C-D insulating materials.

SEE OUR CATALOG IN SWEET'S

SEC-46

## C-D PRODUCTS

**THE PLASTICS**

DILECTO—Thermosetting Laminates.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

**THE NON-METALLICS**

DIAMOND Vulcanized FIBRE.
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

**STANDARD & SPECIAL FORMS**

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

**DESCRIPTIVE LITERATURE**

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also available.

Continental-Diamond C-D Engineered Non-Metallics

BRANCH OFFICES: NEW YORK 17 • CLEVELAND 14 • CHICAGO 11 • SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES
WEST COAST REPRESENTATIVES: MARWOOD LTD., SAN FRANCISCO 3 • IN CANADA: DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

**Continental-Diamond FIBRE COMPANY**

*Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE*

# LOAD BUILDING

## Infrared Drying Method Utilized In the Processing of Potatoes

AN EXPOSURE to radiant heat and germicidal rays is a recent addition in the preparation of Everglade-grown potatoes for the market.

The complete processing includes washing, drying, treating and bagging, mechanized operations, as outlined by P. P. DeMoya, in *Sunshine Service News,* published by Florida Power & Light Co., Miami. With the processing devices and conveyors considered as a machine, it has a capacity of 30,000 lb. of potatoes per hour and a connected load of 85 kw.

For the seemingly deluxe treatment the "new" potatoes, also known as "No. 1 Red Bliss," when brought from the field, are dumped on a screen conveyor for removal of trash and small potatoes (under 1-in. diam.). In succeeding units the potatoes are washed under pressure sprays and passed through a series of power-driven brushes for scrubbing to remove the remaining dirt. From the brush compartment the potatoes drop into a sulphur fungicide bath, are drained on a slotted conveyor and then passed under four fans where the residue of the sulphur bath is blown off.

The potatoes are put on a cross conveyor and carried to the drier units. On entering the drying cabinet the potatoes pass under two exhaust fans which pull the moist atmosphere out of the drier. In the drier the potatoes are subjected to radiant drying energy from 288 infrared, reflector type, 115-volt bulbs having a connected load of 72 kw. The infrared lamps are arranged in banks with plug connections at the outside of the cabinet.

Twice the potatoes travel the length of the drier for a total of 80 ft. First on the upper conveyor they travel 40 ft. and pass directly under the infrared lamps; then they are carried in the opposite direction on the conveyor immediately underneath. A baffle is placed between the two conveyors to control the circulation of air through the drier. Thus in the last 40 ft. of travel the drying is accomplished by convection heat circulating through the cabinet. Midway on the lower conveyor the potatoes pass through the rays of four 30-watt germicidal lamps, to destroy bacteria, the better to keep them.

Upon emerging from the drier, the potatoes are conveyed to a grading table where those defective and bruised are culled out by hand. They then pass through a sizing machine and are put in bags.

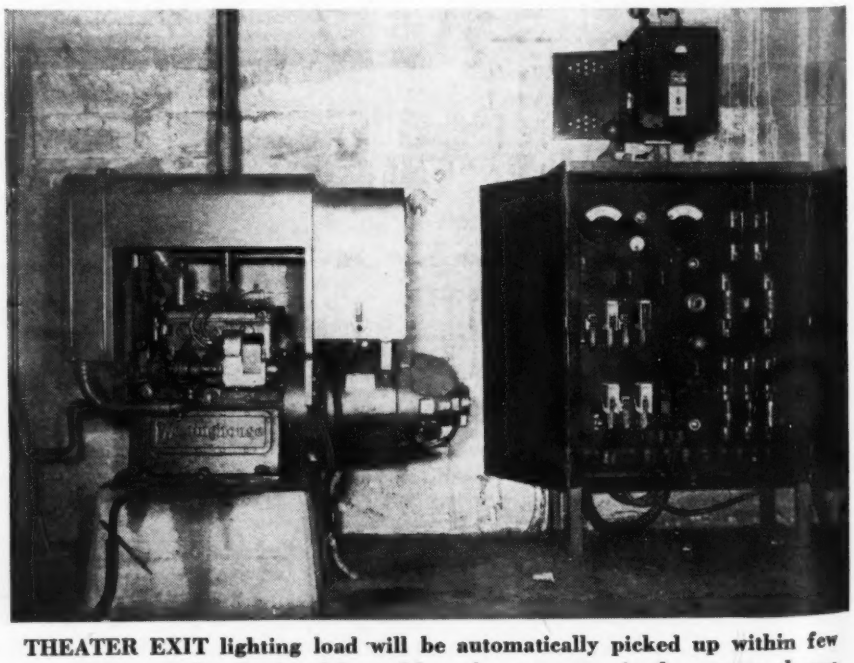
The machine was built by the American Machine Corp. of Orlando, Fla., and is owned and operated by John Dulaney, manager of the Pahokee State Farmers Market.

• • •

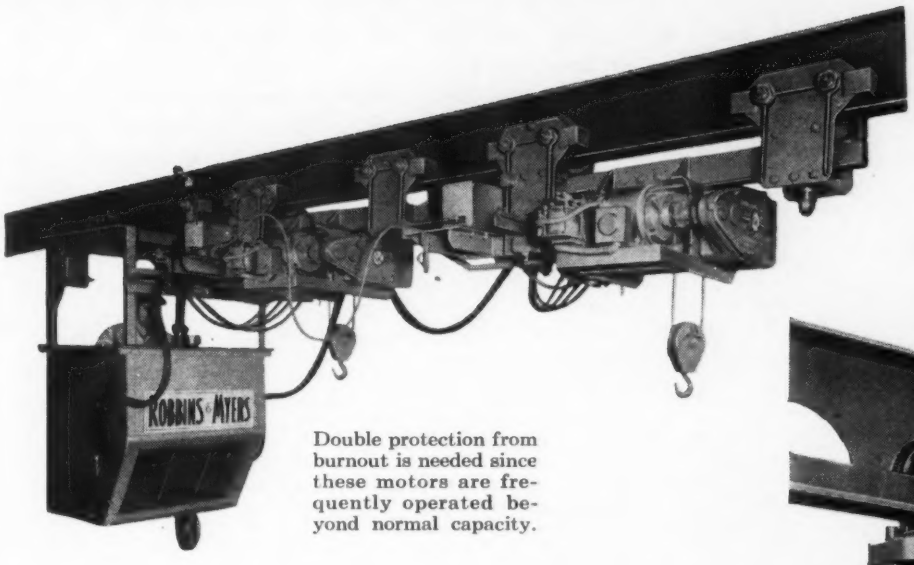
## Engine-Generator Supplies Emergency Lighting

EMERGENCY LIGHTING SERVICE for one of the Portland (Ore.) theaters served by Northwestern Electric Co. is supplied by the gasoline engine-driven generator set shown. Although this is now more or less standard practice for supplying emergency exit lighting for theaters, nevertheless it is the only such installation in the city of Portland. The set consists of a four-cylinder gasoline engine driving a 6-kw., d.c., 115-volt Westinghouse generator. Control is so arranged that loss of central station power supply actuates relays and contactors to start the emergency set automatically and pick up the load within a few seconds. Five 6-volt automobile type storage batteries in series are used for starting the engine. Weekly starting of the machine insures reliability.

There are two power companies serving Portland and most theaters are provided with a manual throw-over switch to the other company's

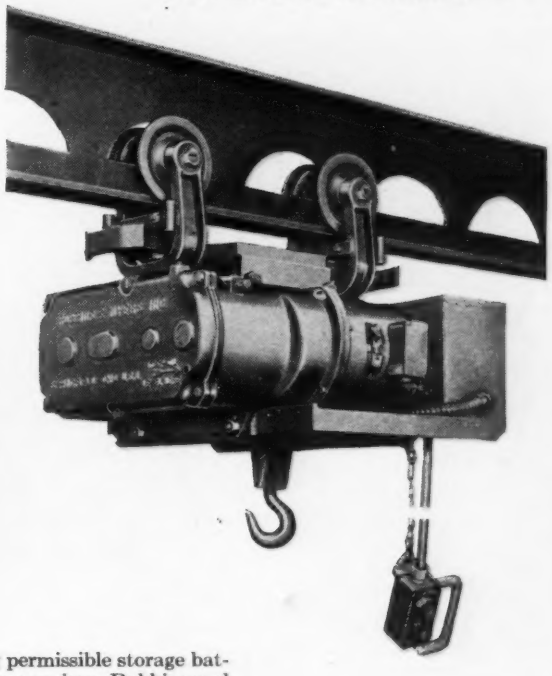


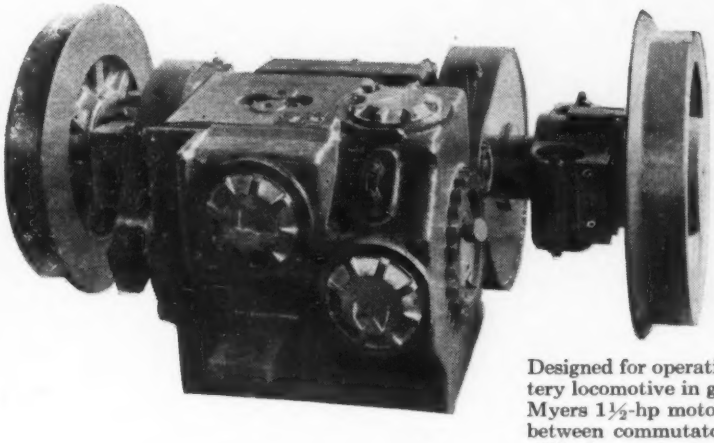
**THEATER EXIT lighting load will be automatically picked up within few seconds by gasoline-engine-driven, 6-kw., d.c. generator in the remote chance of failure of central station supply**




Double protection from burnout is needed since these motors are frequently operated beyond normal capacity.

Robbins and Myers use Micanite rings for insulation on totally enclosed motors built for electric hoists.



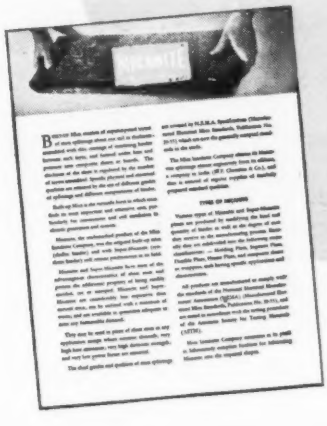


Designed for operating permissible storage battery locomotive in gaseous mines, Robbins and Myers 1½-hp motor relies on Mica insulation between commutator segments, Lamicoid slot sticks in armature, and Micanite tapes for long, carefree operation.

# MICA *Insulator* COMPANY

**Dept. 30, Schenectady 1, New York**

**SALES OFFICES: Boston • Chicago • Cincinnati • Cleveland • Detroit • New York • St. Louis • Philadelphia • Rochester**
**Western Fiberglas Supply, Ltd., San Francisco, California, and Los Angeles, California**



## JUST OUT

**New 4-page bulletin on Micanite and Super-Micanite insulation. Contains information about various grades and suggested applications. Send for your free copy.**

Mica Insulator Company, Dept. 30,
P. O. Box 1076, Schenectady 1, N. Y.

Gentlemen:

( ) Please rush my copy of your new four-page bulletin on Micanite insulating material.
( ) Enclose price list.
( ) Please have your application engineer see me when in my vicinity.

Name_____

Position_____

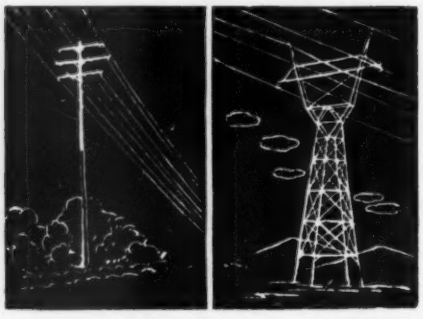
Company_____

Address_____

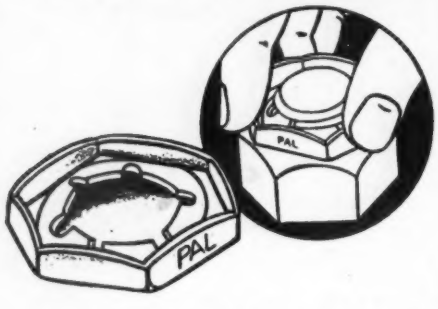
City_____ State_____

# ELIMINATE RE-TIGHTENING OF NUTS

## *On Steel Tower and Wood Pole Lines*



***Specify Palnuts on new lines***
***Add Palnuts to existing lines***




**For over 10 years, Double Locking Palnuts have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.**

**When applied on new installations, Palnuts save future check-ups and re-tightening. Maintenance crews checking old installations can add Palnuts without disturbing regular nut. Only 3 bolt threads space are required. Palnuts are very low in cost; may be removed and reused. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.**

**SEND details of your needs for samples. Write for Palnut Manual and detailed folder on power line applications.**

**THE PALNUT COMPANY**
**51 Cordier St., Irvington 11, N. J.**

DOUBLE-LOCKING
PALNUTS


service for exit lighting. Several theaters, on the other hand, use storage batteries floating on the line. However, the expense of maintaining storage batteries and charging equipment year after year, with use practically nil, led this one theater to replace batteries with the engine-driven generator set. Several disastrous fires in public places in recent years have focused attention on the necessity for reliable emergency service in case of power failure.

•

## Home Service Training Given Factory Slant

**GROUP of Connecticut Light & Power girls participating in visit to appliance manufacturing plant to obtain closer understanding of the design and processing of household electrical conveniences**

TO ENLARGE the knowledge of electrical and gas appliances for domestic use among members of its home service department, the Connecticut Light & Power Co. has established a program of factory visits and other manufacturing field contacts as a part of their training. The first meeting was held at the plant of Landers, Frary & Clark in New Britain, and since then other meetings have been held in Waterbury for the Westinghouse "Laundromat" and in Hartford on the premises of the distributor of the Bendix home laundry. A fourth gathering was scheduled in Waterbury in October where representatives of the Frigidaire Sales Corp. displayed their products and later this fall another meeting will take place at the General Electric Home Institute in Bridgeport.

In general it is not necessary for the girls to travel any great distance to receive instruction. Arrangements have been made for some manufacturers' representatives to visit the utility company's headquarters in Waterbury rather than to have the girls go to Boston or to the factory in a distant state. The meetings permit the manufacturers' representatives to present their story and give valuable assistance to the girls who will, as a result, be better qualified to lecture and demonstrate the specific appliances.

•

## Making Chores Easier On the Farm

RESEARCH to reduce farm labor and improve crop production has an important bearing on load building. T. E. Hienton, head of the division of plant industry, soils and agricultural engineering, A.R.A., U. S. Department of Agriculture (Beltsville, Md.), touched upon such research trends at the recent meeting of the North Atlantic section, A.S.A.E., in Fairlee, Vt., under the following enumerated sections:

(1) Development of electrical equipment to aid in doing chores. At present it is estimated that farmers spend 20 to 60 percent of their time in such daily routines. A survey of 85 farms in the Corn Belt revealed that an electric pump to supply water in the poultry yard cut down by one-half the amount of labor needed to care for laying hens.

(2) Development of construction standards for general purpose farm refrigerators. This seeks to include desirable capacities and possibilities of home construction. Farmers need such equipment to care for surplus products such as eggs, poultry, fruits, vegetables and dairy items until they can be conveniently sold or used.

(3) Use of bactericidal lamps in animal shelters and storage cellars. Experimental installations are now in use. Poultrymen have been interested in their application for controlling respiratory diseases and dairymen in their use for sterilizing utensils. Definite data are being sought on the influence, limitations and costs of such lamps. Reductions in corn borer infestation of 70 percent have resulted from the use of one lamp and insect trap per acre. Further tests will be made of the effect of visible and invisible radiation upon corn borer moths, and upon other insects.

(4) Use of infrared electric heaters to dry seeds and other valuable crops, and for thermal therapy in treating farm animals. It is proposed further to study farm uses of radiant heaters, such as infrared lamps. Their application in drying hybrid seed corn, vegetable seeds and other grains may better improve these seeds for storage and result in improved viability. Electrical heat treatment for mastitis in farm animals is proposed.

(5) Use of ultrasonic vibrations for treating seeds and possibly attracting insects is proposed. Recent reports from Russia and Italy are highly favorable and accurate data are needed to evaluate this electrical application.

Research in farm electrification faces an opportunity to make a major contribution to American agriculture. An acre of corn can now be produced with as little as 3.6 man-hours against

# The Message Gets Through—REGARDLESS!

Motorola F-M equipment in a fixed transmitting station.

Motorola Mobile Unit mounted on a line patrol car.

A privately owned Motorola 2-way Radiotelephone Communications system is more economical and will give you better service than any other type of communications system that may be offered you.

## Motorola 152-162 MC.
## 2-WAY F-M RADIOTELEPHONE HELPS MAINTAIN CALIFORNIA POWER SUPPLY

Come what may in nature's bag of tricks, Motorola messages *get through!*

Here, in the high Sierras, Motorola 152-162 mc. 2-way F-M radiotelephone system is on 24-hour vigil, aiding line-patrolmen of the California Electric Power Company in maintaining mountain-strung power-lines. Through sandstorm, cloudburst, or blizzard, Motorola radiotelephone (like the famous war-born Motorola "Handie Talkie") is providing constant, infallible contact between vital stations, helping to shoot trouble at its source in seconds' time.

What's more, Motorola's exclusive individual and group calling operation insures privacy . . . the famous reserve gain feature of Motorola's F-M receiver means utmost economy.

As organizations in all phases of public service turn to Motorola for radiotelephone communications, the merit of the choice becomes increasingly obvious: Motorola can be depended upon *at all times, under all conditions!*

Let one of our expert field engineers demonstrate to you how the efficiency of *your* operation can be increased through the use of Motorola radiotelephone.

**GALVIN MFG. CORPORATION • CHICAGO 51**
COMMUNICATIONS AND ELECTRONICS DIVISION

MONEL BOLTS ARE BEST
...AGAINST SALT CORROSION
A filter used in Morton Salt Company brine evaporating process. Nickel Alloy drums use Monel Metal bolts and rivets.
OF the destructively corrosive effect of salt and salt brine upon common steel probably no one knows more than the Morton Salt Company . . . "when it rains it pours."
To reduce maintenance costs in their salt mining and evaporating processes the Morton Company relies upon Monel Metal in contacts with salt and salt brine, using Harper fastenings of the same non-corrosive, non-rusting alloy.
If you have chemical corrosion problems in your industry it will pay you to use Everlasting, non-ferrous fastenings. Consult Harper Engineers or order any of Harper's more than 4850 different types from stock.
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15 man-hours in 1900, by utilizing modern equipment. By contrast it is estimated that the farmer needs 80 hours to care for one cow for a year and 262 hours to handle the average flock of 125 hens. Electrical developments to cover the repetitive operations of such chores are essential.

•

## The Case for Rural Merchandising


J. D. HOWARD
General Sales Manager
Wisconsin Power & Light Co.
Madison, Wis.


BASED on past experience and a study of distribution economics, we believe that every utility serving a rural area should merchandise appliances.

In studying the operations of several other utilities, it was found that companies which did not merchandise lagged the national trend in development of consumer usage of services. It was also found that companies having strong merchandising and dealer cooperation programs obtained results far in excess of companies not having such a combination program. A few of the many other reasons for our conviction are:

1. Only a utility company can adequately pioneer the market introduction of service-consuming products.

2. The utility must merchandise if it expects to have a stable market relatively free from price cutting and unfair competition, and wants all dealers to handle quality appliances.

3. When all costs are taken into consideration, the cost of sales promotion in attaining a comparable result is higher when the utility does not merchandise than when it does.

4. When a utility does merchandise, it has a stronger voice in national trends and service to customers.

5. When a utility is in the merchandising business, better service to the consumer results, and it offers the utility greater opportunity to develop and maintain good customer relations.

6. When a utility merchandises, dealers are more favorably disposed to sell service-consuming appliances rather than to sell those using other fuels.

# IDEAS FOR YOUR FUTURE . .

THE key to your future may lie in the answers you can get at the coming Air Conditioning Exposition. Information on latest products . . . newest trends . . . available sources of supply . . . answers to these and other current questions will be on tap for you at the Exposition. The ideas and information you get may be your greatest business asset in the months to come.

Under one roof—in one short week or less—through more than 300 technically staffed exhibits—the Exposition offers you more information, more contacts, more IDEAS than you could get in any comparable time or way.

You'll see what's newest and best in all types of heating, ventilating, air conditioning and related equipment. You'll talk to engineering specialists at the exhibition booths—men specifically on hand to help you with your problems, tell you what you want to know.

No engineer, architect, manufacturer, building owner, contractor, or distributor can afford to miss this first Air Conditioning in seven years . . . and the biggest ever! Be sure to attend. Admission by registration only.

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*The Air Conditioning Exposition*

LAKESIDE HALL, CLEVELAND, OHIO

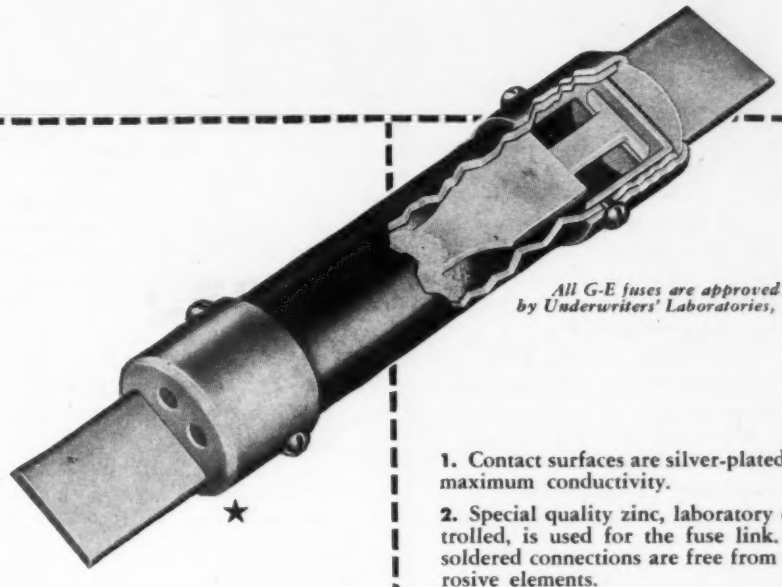
JANUARY 27-31, 1947

Under the auspices of the American Society of Heating & Ventilating Engineers

Management of International Exposition Co., Grand Central Palace, N. Y. 17, N. Y.

# 8 good reasons

## WHY G-E SILVEND* FUSES provide lasting protection for electric equipment



*All G-E fuses are approved by Underwriters' Laboratories, Inc.*

G-E Silvend fuses are especially desirable for improving continuity of electric service and reducing maintenance time.

The silver-plated contact surfaces of G-E Silvend fuses maintain good electrical contact as long as the fuses stay in service. There is no heating due to oxidation to cause premature blowing.

G-E Silvend fuses are particularly suited for use with apparatus having silver-plated fuse clips. They will, however, give better service than ordinary fuses where brass or copper clips are used.

For further information, get in touch with your local G-E Merchandise Distributor, or write Section D9-119, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.*

**1.** Contact surfaces are silver-plated for maximum conductivity.

**2.** Special quality zinc, laboratory controlled, is used for the fuse link. All soldered connections are free from corrosive elements.

**3.** The filler is made under laboratory controlled conditions of temperature and humidity. It has proper texture and does not cake.

**4.** The casings are accurately gaged to assure tight fit. Amperage ratings are stamped on enclosure.

**5.** Casing is of moisture-resistant, treated fibrous material.

**6.** Caps for ferrule-type fuses (3-60 amp) are crimped and staked to the casing. On blade-type fuses (61-600 amp), caps are securely bolted to a steel support or yoke inside the casing.

**7.** This yoke prevents fuse blades from twisting, and assures proper contact alignment.

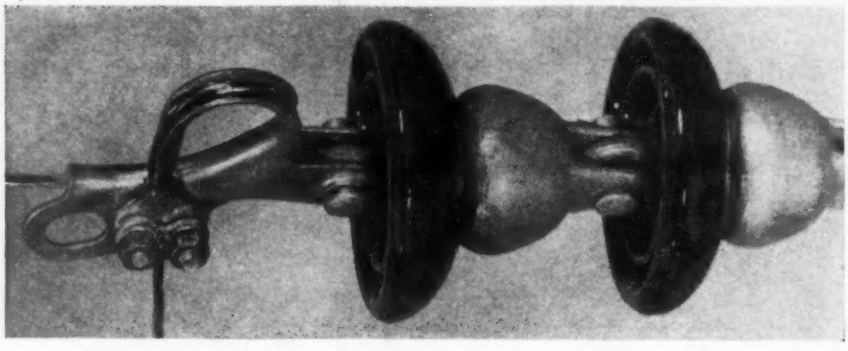
**8.** All G-E fuses are accurately calibrated under laboratory supervision to pre-determined characteristics. Exclusive G-E tests assure maximum standards of fuse performance.

★

GENERAL ELECTRIC

# NEW EQUIPMENT

## New Strain Clamp Has One-Piece Body



A NEW STRAIN CLAMP, with a one-piece body and no riveted or welded points to "weep acid" after galvanizing, will be introduced by Brewer-Titchener Corp., Cortland, N. Y., in December. It is pressed from heavy-gage steel and hot-dip galvanized.

The strain clamp, BTC No. 2106, handles a wide range of conductor cable sizes, from a minimum of 0.160 in. to a maximum of 0.366 in., and thereby reduces storeroom stocks. It is reported as having adequate ultimate and slip strength and to minimize the effect of cable vibration because of its light weight and short connecting length. The large snubbing radii, die-formed seat, and long clamping section are stated to prevent conductor damage. A come-along loop is provided to simplify take-up.

It is approved by REA for use on 3 No. 12, 40 percent, H.S. All Copperweld; No. 4A, 6A, 8A, 8C, and 9½D, Copperweld—Copper Composite; No. 6 and 8 Crapo, Ruralductor, Amersteel; and No. 6, 8, 8X, 9X, 10 and 12 Amerductor SCP and SCG.

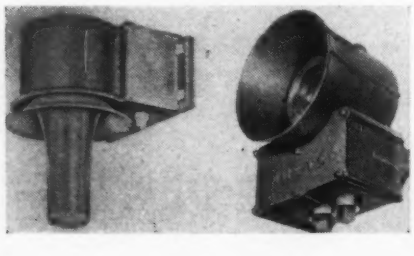
•

## Speakers Built For High Humidity, Dust Area

TWO LOUDSPEAKERS designed for use in areas containing coal dust or live steam have been developed by the University Loudspeakers, Inc., 225 Varick St., New York 14, N. Y. Both units may also be mounted outdoors since they have been waterproofed and are self draining.

The speakers are built of aluminum castings and are equipped with Alnico 5 permanent magnet dynamic driver units. Model MSR, left, consists of a reflex air column horn, a radial deflector for 360-deg. dispersion, and a hermetically sealed housing enclosing the driver unit. The housing also provides mounting facilities for a constant-impedance attenuator and a line matching transformer if needed.

Model MM-2TC is a directional speaker consisting of a reflex air column horn and a hermetically sealed housing enclosing the driver unit. Power of the unit is 15 watts; dispersion, 120 deg.; frequency 300 to 6,000 cycles; and weight, 8 lb. Power of model MSR is also 15 watts; dispersion 360 deg.; frequency 250 to 600 cycles, and weight, 12 lb.



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## Conducting Glass Protects Meters from Stray Currents

PROTECTION of instruments from stray field currents and elimination of fogging on windshields has been obtained by a recently disclosed development of the Pittsburgh Plate Glass Co., 632 Duquesne St., Pittsburgh, Pa. The development, called Nesa coated glass, is a transparent solid which is reported to combine good visual properties with electrical conductivity and thereby allow current to be conducted for heating and for fog prevention and away from the glass to ground for protection against stray currents.

Electrical contact to Nesa is made by painting on busbars of silver paste, which when properly fired becomes metallic silver. Copper conductors are then soldered to the silver. The surface can be effected on plate glass, laminated safety glass and multiple-glazed units for aircraft.

Plate glass so treated will dissipate up to 4½ watts per sq. in. in ambient air having a temperature of 80 deg. F. For laminated safety glass this is limited to 3½ watts per sq. in. because of the vinal plastic innerlayer.

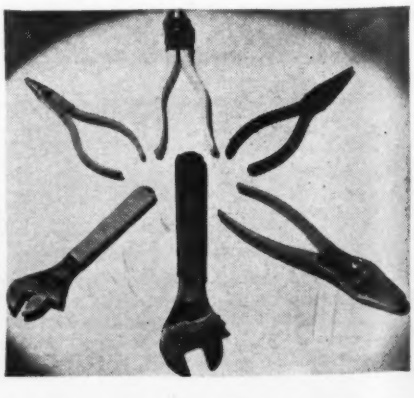
The development was successfullly utilized during the war in protecting instruments on radar equipment from stray field currents.

•

## Plastic Shrinks on Tool Handles; Acts as Insulator

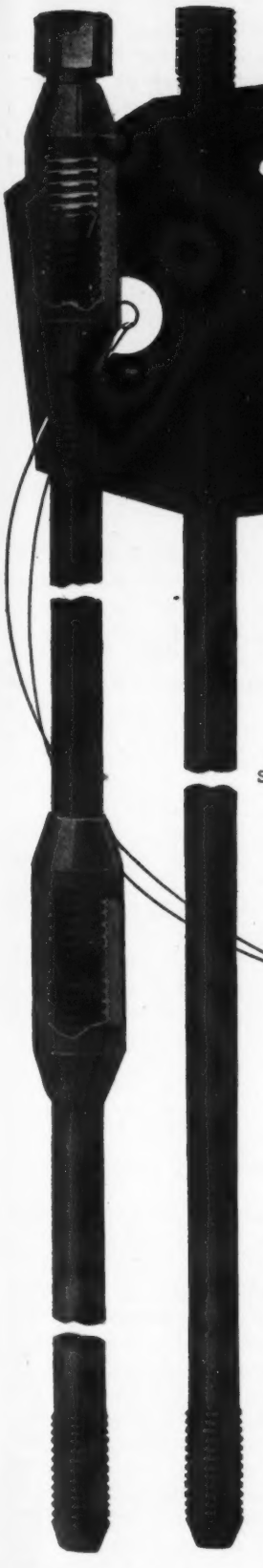
A PLASTICS MATERIAL that is made to shrink on the handles and grips of pliers, wrenches and wire cutters to serve as an electrical insulator has been developed by the plastics division, General Electric Co., Pittsfield, Mass. The material is applied after it has been immersed in a special dilator solution which causes it to expand half again its normal size. When thoroughly dry, it shrinks to smaller than its original size to form a tight fit over the handles.

The plastic is available in cap and

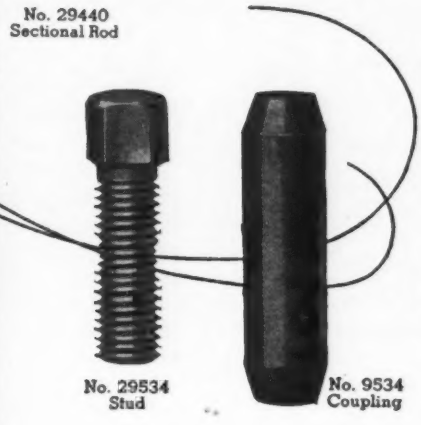


# The Endurance of Copper-Plus The Strength of Steel

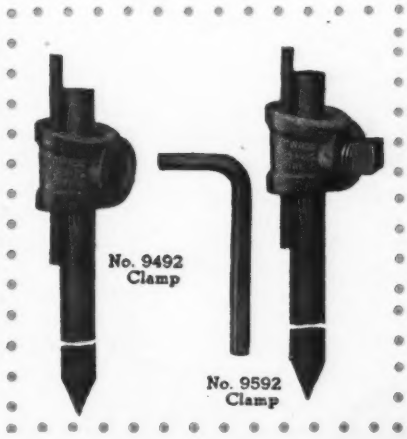
# HUBBARD-COPPERWELD SECTIONAL GROUND RODS



Assembly of Sectional Rods—Couplings and Stud




Hubbard-Copperweld Sectional Ground Rods have been designed for use in locations where deep grounds are necessary to reach firm soil. The use of sectional rods eliminates the nuisance of extra long rods which are clumsy to handle in the warehouse and on the truck. Sectional rods are the same as standard except that they are threaded on each end. Joining is accomplished by couplings as shown. For driving purposes a stud bolt is inserted in the coupling at the top of each section.




| Stock No. | Description | Size | Approx. Wt. per 100 Pcs. |
|---|---|---|---|
| 29430 | Sectional Rod | 1/2" x 10 Ft. | 550 |
| 29440 | Sectional Rod | 5/8" x 10 Ft. | 860 |
| 29450 | Sectional Rod | 3/4" x 10 Ft. | 1220 |
| 9533 | Coupling | 1/2" | 18 |
| 9534 | Coupling | 5/8" | 30 |
| 9535 | Coupling | 3/4" | 46 |
| 29533 | Stud | 1/2" | 15 |
| 29534 | Stud | 5/8" | 23 |
| 29535 | Stud | 3/4" | 35 |
| 9491 | Safety Set Screw Ground Clamps | 1/2" | 25 |
| 9492 | | 5/8" | 35 |
| 9493 | | 3/4" | 45 |
| 9591 | Sq. Head. Set Screw Ground Clamps | 1/2" | 25 |
| 9592 | | 5/8" | 35 |
| 9593 | | 3/4" | 45 |

## HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.

EXCLUSIVE NATIONAL SALES AGENTS FOR COPPERWELD GROUND RODS AND CLAMPS

# BERMICO*
## FIBRE CONDUIT

## FOR SUREST CABLE PROTECTION---
## SPECIFY BERMICO CONDUIT

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for tight, speedy, installations.

3 **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.

4 **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.

5 **WATER PROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.

6 **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.

7 **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!

8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

*distributed by*
**WESTINGHOUSE ELECTRIC SUPPLY COMPANY**
Offices in all leading cities

* Reg. Trade Mark

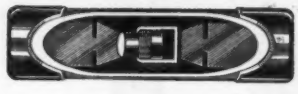
BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY


sleeve form for application in diameters up to an inch and in any length. The fact that it swells to half again its normal diameter plus the fact that it can be stretched considerably while in the swollen state permits coverings of larger diameters.

•

### Fuse Thermal Capacity Matches Equipment

A NEW dual-element fuse, called the Trion, which is designed to match the heat-absorbing capacity of the protected motor or transformer, has been



developed by the Chase-Shawmut Co., 374 Merrimac St., Newburyport, Mass. It is reported to absorb heat ampere for ampere with the protected apparatus. The fuse consequently has a long time delay, the company reports five times that of previous designs, allows the motor to start under a heavy overload but, should the overload be too great for the motor, "blows" because of the matched thermal qualities.

It can also be used with the push-button type of motor switch, at the same current rating as that of the thermal relay heat unit, for protection of switch and motor.

The fuse operates at 286 deg. F. It blows instantly on short at a series of points in succession and thereby reduces rate of recovery voltage rise.

•

### Electric Comforter Has Removable Heat Elements

USING a 150-watt heating element stitched to the inside washable muslin warming sheet, an electric comforter with rayon satin covering has been made available by Westinghouse Electric Corp., Mansfield, Ohio. It is designed to fit a double bed and to cling to the bed sheet. Four concealed thermostats of a bimetal type are attached to the warming sheet and are hermetically sealed against air, dust, and water. Heating wires are made of cadmium bronze alloy helically wound for flexibility and insulated with a plastic. Bedside control box has a pull switch with red visual indicator, neon light and warmth selector knob. The comforter can be cleaned. The warming sheet is removed by first opening a 36-in. zipper on the bottom end of the comforter, turning the comforter inside out and opening the ties that hold the warming sheet in place. Then the rayon satin covering can be dry cleaned and the inside warming sheet may be washed at home.

## Where and How to Use *Crapo* Steel Conductor

### Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

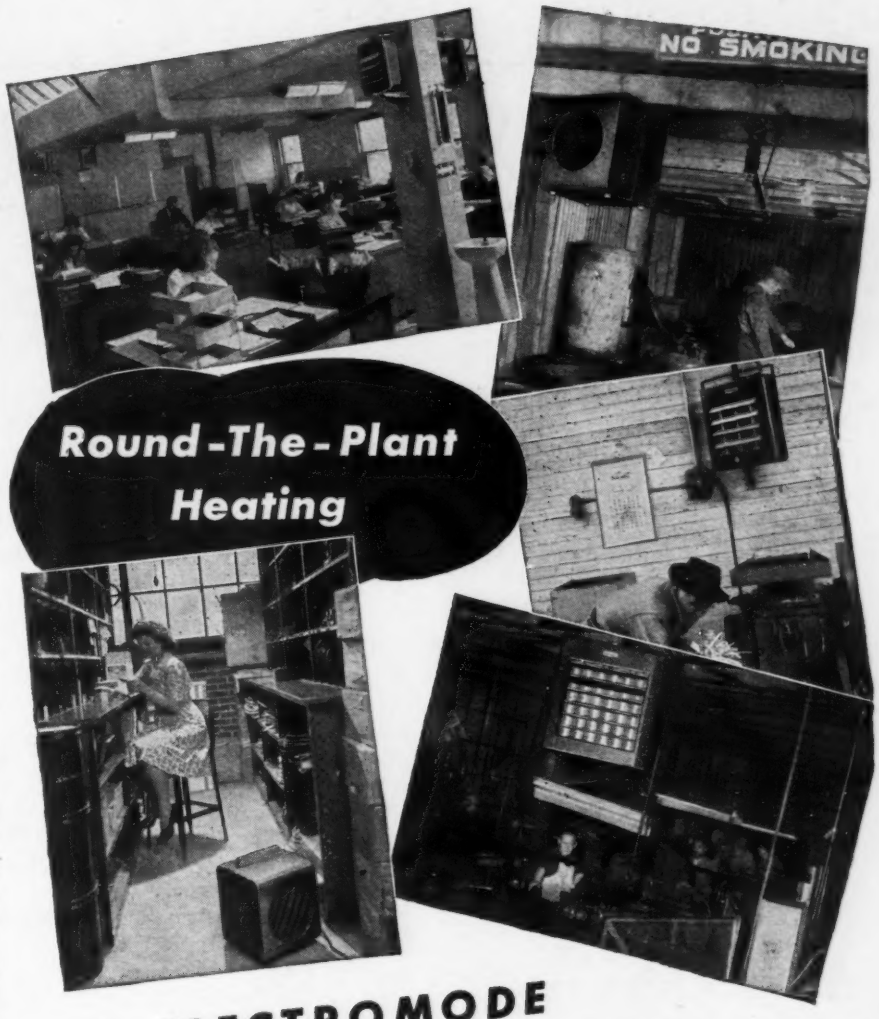
This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

*Crapo* Steel Conductors are especially applicable to rural taps and branches where construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.

*Crapo* Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

**Indiana Steel & Wire Company**
**Muncie, Indiana**

**Crapo Steel Conductors**

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Heat—anywhere in the plant—in factory, stockroom, office, warehouse, is possible with the installation of Electromodes. Wherever circuit wires can be run,—to isolated buildings, or beyond central heating system range,—Electromodes can furnish clean, safe, heat economically.

For local or supplementary heat when some departments are running overtime, for week-ends, holidays and inventory periods, Electromodes save on heating costs. There is no heat-loss en route from wires to heater. No current is used when not "on."

Cut-away view of exclusive Electromode Finned Heating Element as used for years to heat U. S. Submarines. No fire, shock or explosion hazards.

Long-life service, free from fire, shock or explosion hazards, is another Electromode advantage. The patented heating element is insulated, sheathed and embedded in a one-piece finned aluminum casting. There are no exposed hot wires or glow elements. Standard capacities, 1.5 KW to 60 KW. Ask your Electrical Wholesaler to recommend appropriate sizes.

ELECTROMODE CORPORATION, Rochester 3, New York.

**ELECTROMODE Electric Unit Heaters**

*Send for latest Bulletin 45-U and Heating Analysis Form.*

# NEWS ABOUT PEOPLE

## Ohio Power Co. Elects Turner Vice-President

At a meeting of the board of directors of the Ohio Power Co., Harold Turner was elected a vice-president of

H. TURNER

the company and a member of the board. Mr. Turner succeeds the late E. A. Lewis, vice-president and general manager.

Mr. Turner went to Canton, the operating headquarters of the Ohio Power Co., in 1941 as assistant general manager and succeeded Frank Howard on his retirement. Previous to 1941, Mr. Turner was a member of the engineering staff of American Gas & Electric Co., of which group Ohio Power Co. is a part. Beginning in 1926 as an engineer in the system protection section, Mr. Turner became in 1934 executive assistant to the vice-president and chief engineer of American Gas & Electric Service Corp.

Before entering the utility field, Mr. Turner spent a year in the test department of General Electric Co. at Schenectady, N. Y., and Pittsfield, Mass., followed by periods in the a.c. engineering department and the central station engineering department at Schenectady.

Mr. Turner is a member of A.I.E.E., The Franklin Institute, and the Ohio Society of Professional Engineers.

•

► J. ALDEN TROVILLO, assistant secretary of Underwriters' Laboratories, Inc., has left the laboratories after twelve years' service. Mr. Trovillo has taken a position with the University of Kansas at Lawrence as associate professor of science and business and will devote his time to the teaching of industrial management.

•

## Line Material Co. Elects Rubow Vice-President

C. W. Rubow has recently taken over the duties of vice-president and general manager of the Line Material Co. of Pennsylvania at East Stroudsburg. Mr. Rubow joined the Line Material organization at South Milwaukee, Wis., in 1926 and two years later was transferred to East Stroudsburg as office manager and assistant secretary. Later he became purchasing agent and in 1944 he was made assistant general manager and treasurer.

Before his affiliation with Line Material, Mr. Rubow was connected with the American Appraisal Co. and with the Worthington Pump & Machinery Corp.

Michael Ruggieri has been appointed

C. W. RUBOW

plant manager of the company's factory at Birmingham, Ala. He has been a member of the L-M organization for more than 15 years, most recently serving as chief engineer at the East Stroudsburg, Pa., plant. Mr. Ruggieri has been active in committee work for the National Electrical Manufacturers Association and is a member of the joint NEMA-EEI committee on standardization of street and highway lighting.

## More New England Power System Appointments Made

Paul B. Metcalf has been appointed executive assistant to Walker Mason, executive vice-president of the Narragansett Electric Co., Providence, R. I., following several months as executive assistant in the office of Vice-President William Webster of the New England Power Association, Boston.

Mr. Metcalf has been identified with the New England Power System since

P. B. METCALF

1918, in connection with steam plant operations, and has had contacts with various government boards in Washington, D. C. He served in World War I in the field artillery, and in World War II in army staff duties in England, France and Germany. Part of his work was restoration of generating plants in the Rhineland, and for a time he headed the utility section of the military government in Bavaria.

Albert C. Gowing has been named assistant chairman of the distribution standards committee, New England Power System, Boston. After being employed by the Boston Edison and Weymouth Light & Power companies, he engaged in independent industrial and appliance sales work. In 1921 he joined the Union Light & Power Co., Franklin, Mass., as an engineer and was its manager from 1936 to 1945, when he was made local manager of Franklin office of Worcester Suburban Electric Co.

John F. Conroy, in charge of sales

# Steel Shortage

# Emphasizes Need for —

## 1. Better plant maintenance

## 2. More care in storing steel

## 3. More ingenuity in adaptation

Today's shortage points up as never before the importance of using every available pound of steel to best advantage. It's the responsibility of buyer and seller alike.

Because a machinery breakdown may necessitate replacements not readily available under present conditions, extra maintenance care is essential. Regular painting of exposed surfaces and thorough lubrication of working parts will often prolong the useful life of plant property and equipment considerably.

Industry can cooperate by more careful storage and handling of its steel inventories. Many manufacturers have some steel on hand, but inadequate protection and poor handling facilities may cause deterioration and sometimes the stocks are not in satisfactory condition when needed.

Ingenuity in adapting steel on hand to needs of the moment is a third essential today. Steel buyers can help by specifying cut size on orders for stock lengths, allowing steel-service plants to draw on their inventory of shorts. And the steel warehouse itself can make wide use of adaptation. For example, Ryerson plants continue to carry fair stocks but orders for popular sizes of many products are so numerous that the demand cannot always be met. When this happens, we can often suggest alternate kinds or sizes to do the job. An alloy bar replaces a carbon bar. Two angles form a square tube. In one way or another we may be able to help keep production moving despite the steel shortage.

Our organization is constantly on the watch for ways to make the available steel supply useful to more customers. We promise no miracles, but we will certainly do everything in our power to serve you when you call.

**Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.**

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Stephens Climbers, manufactured by Buckingham of Binghamton for more than 45 years, have built an international reputation for safety and comfort.

**Buckingham Easy Belt No. 58**

Safe and comfortable, it's made of tan harness leather, lined with soft chrome lace-leather. No metal contact with the body. Forged Dee-ring and buckles are individually tested.

**Why do Stephens Climbers enjoy the popular demand and confidence of utility companies, telephone companies and individual linemen?**

Because Stephens Climbers, and all other Buckingham safety equipment, are made under one watchword—*quality*. Each climber is tested for safety and carefully inspected to meet the rigid standards and exacting requirements of safety engineers. Every care has been taken to provide comfortable equipment. Our patented Right and Left Climbers, for example, are a distinct improvement which adds materially to the safety and comfort of the linemen.

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**Walter E. Craw, President Binghamton, N. Y.**

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for the Franklin-Milford area of the Worcester Suburban company and former district sales manager of the Frigidaire Sales Corp., Boston, succeeds Mr. Gowing at Franklin. Harlow H. Drown has been made merchandising supervisor of the Worcester Suburban company with headquarters at Milford, Mass., following extended sales responsibilities with the company at Uxbridge and Marlborough.

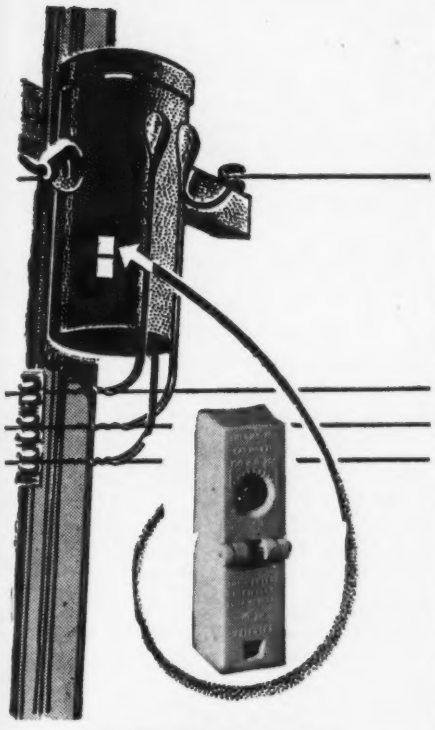
•

▶ A. H. KHAN, superintendent of the electrical department of the Tata Iron & Steel Co., Ltd., Jamshedpur, India, is on a short visit to the United States. The purpose of his visit is to acquaint himself with the latest developments in electrical power generation and in electrical equipment for steel plants. A considerable portion of the electrical equipment installed in the Tata Steel company's plant, situated about 150 miles from Calcutta, is of American manufacture. Tata Iron & Steel Co. is represented in this country by Tata, Inc., 90 Broad St., New York.

▶ RAY W. BRASWELL, assistant to chief engineer of Louisiana Power & Light Co., is leaving the company to become operating superintendent of Mississippi Power & Light Co. Mr. Braswell has been with the Louisiana utility for 20 years. In 1928 he became an engineer for Phoenix Utility, an associate company, and in 1930 became division engineer for Louisiana Power & Light. He has been assistant to the chief engineer since 1940.

▶ EVERETT R. READ of Elizabeth, Ill., has been appointed executive secretary of the division of rural electrification, Arnold P. Benson, state director of agriculture, has announced. Mr. Read has been prominently identified with the progress of rural electrification in Illinois, being president of the Jo-Carroll Electric Cooperative. He was elected a director of the National Association of Rural Electric Cooperatives at a meeting held recently in Des Moines, Iowa, to represent the Association of Illinois Electric Cooperatives, of which he is vice-president. The division of rural electrification has just resumed operation after being inactive since 1943, when its work was halted by wartime curbs on materials.

▶ CHARLES M. FULK, electrical engineer, central station engineering divisions, apparatus department, General Electric Co., Schenectady, N. Y., has retired. Mr. Fulk's employment with General Electric began in 1907 and included the test course, direct current design and field engineering, New York dis-



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Utilities are praising the accuracy of THERMALARM and have placed many orders for them since they became available. They cost little—only $3 each—and will save you much! Place your order today for as many THERALARM's as you need for your distribution system.

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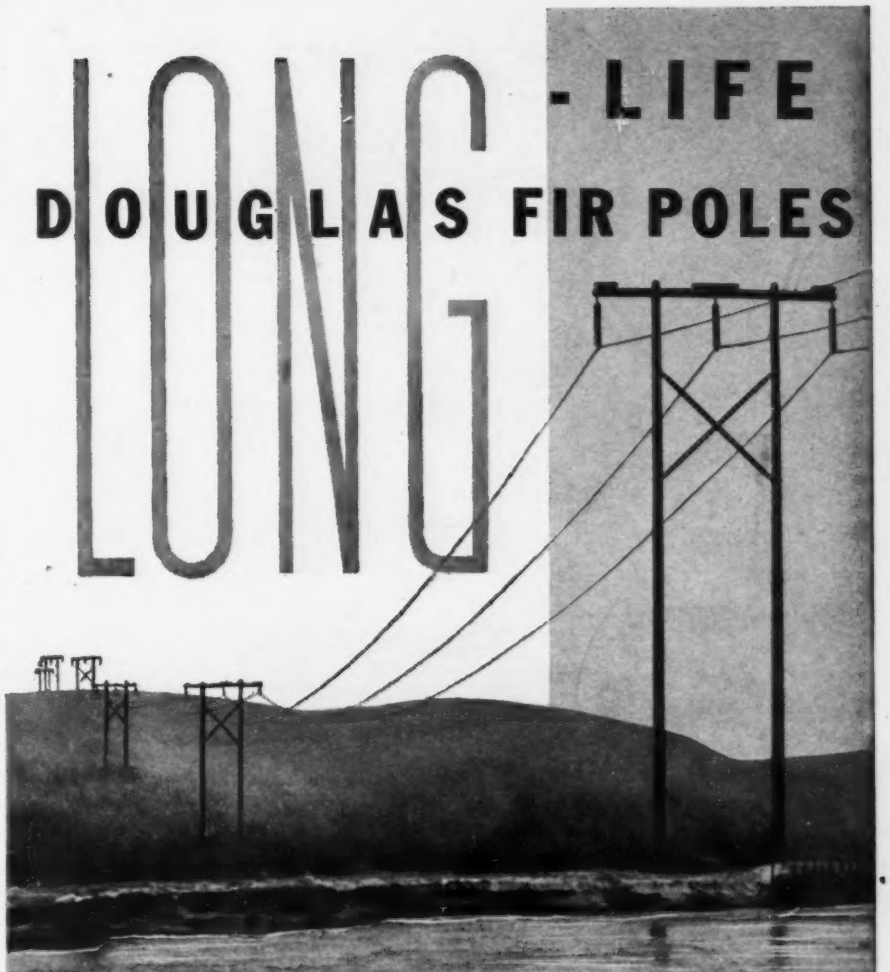
# LONG-LIFE DOUGLAS FIR POLES



Our specialty is long-length Douglas Fir poles, pressure treated for Long-Life service. Prompt shipments of reasonable quantities can now be made in most lengths from 60 foot to 125 foot. Direct rail shipments out of our treating plant stocks can be made to any point in the United States. Write or wire us your inquiries.

Pressure treated Douglas Fir poles have been for years the standard in pole line construction on the West Coast. Our Long-Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

Long-Life Douglas Fir poles, pressure treated from high quality Coast-type timber, will cut your maintenance costs and yield longer and more satisfactory service.

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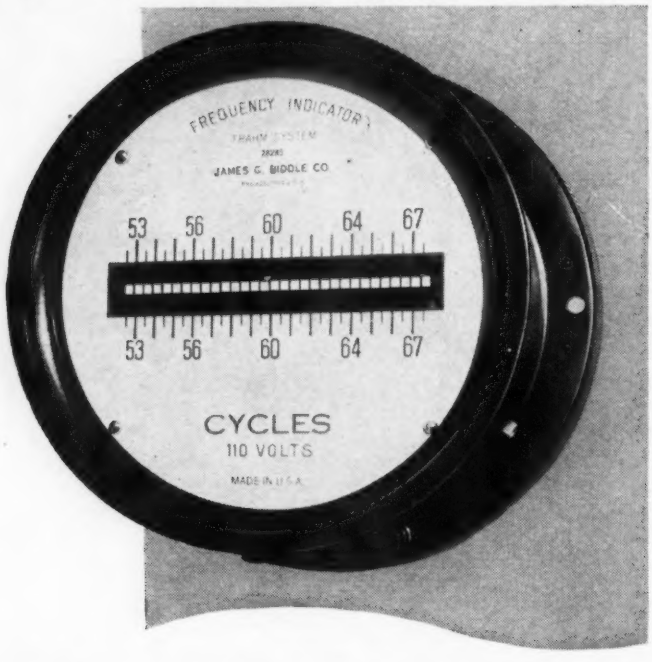
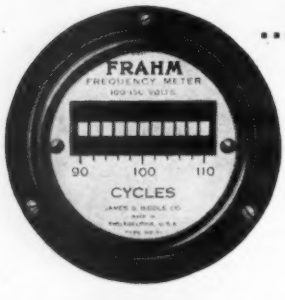
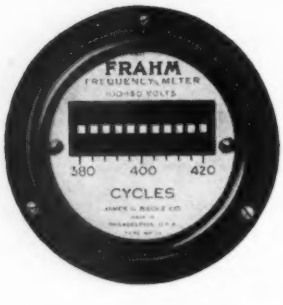
# "FRAHM" Frequency Meters




## What are your Frequency Measuring Requirements ...25...60...100...400.....1400 cps ?




Frahm Frequency Meters in switchboard, miniature and portable types are regularly available for ranges between 15 and 500 cycles per second.

To meet special requirements, our laboratory has designed and built instruments for measuring frequencies as high as 1400 cycles. Such, we find, is possible by means of the same simple and direct resonant reed principle, usually requiring less than 0.1 volt-ampere power input, and without recourse to intermediate frequency conversion equipment. We believe that even higher frequencies are possible.

We invite correspondence regarding any frequency measurement problem in the audio and sub-audio range. For its solution we proffer our instruments, our services and facilities. In our 30 years of association with the resonant reed principle as applied to the measurement of frequency, we have been instrumental in the solution of a surprising variety of problems.

*Write for Bulletin 1770-W.*

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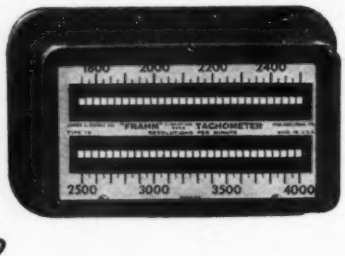
. . . operate on the same unique principle as Frahm Frequency Meters except that reed vibration is produced by direct mechanical contact instead of electrically. Available in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, diesel-electric installations, etc. Various ranges from 900 to 100,000 rpm. Write for Bulletin 1810-W.




James G. BIDDLE CO.
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trict office 1917 to 1922 and application engineering with the central station divisions from 1922 to date.

## OBITUARY

### Joseph Sachs

Joseph Sachs, engineer and inventor, died on November 15 in the Hartford (Conn.) Hospital at the age of 76. Mr. Sachs contributed greatly to the development of a wide range of electrical wiring accessories, notably in the field of fuse protective devices. It was for his work in this field that in 1903 he received the John Scott medal of the Franklin Institute.

Born in New York City, he began his electrical work with the Sprague Electric Motor Co. in New York in 1890, soon afterward joining the Edison Machine Works, now the General Electric Co., at Schenectady. During the ensuing years he engaged in extensive development work, embracing electric railway equipment, electric metal heating and melting, protective devices and switches. In 1898 Mr. Sachs became associated with the Johns-Pratt Co. as consulting and chief engineer and later was president and manager of the Sachs Co. and vice-president and manager of the Sachs Laboratories. Since 1939, he had been research, invention and engineering consultant to several manufacturing companies.

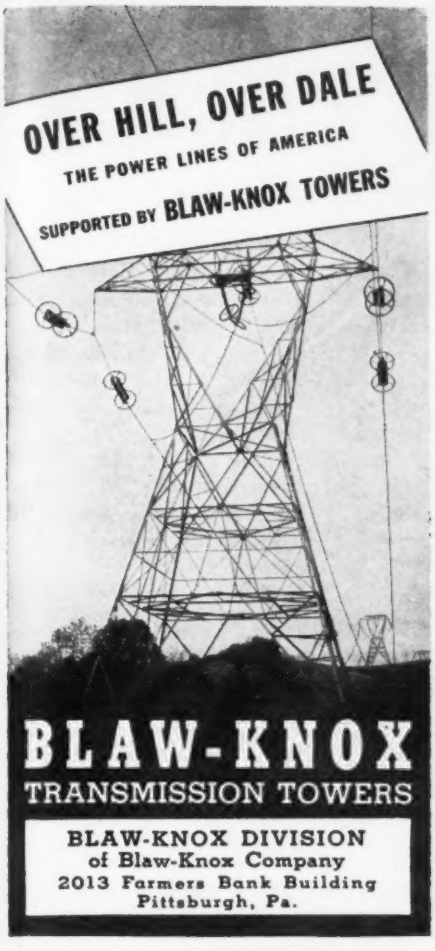
Mr. Sachs had to his credit more than 250 United States patents on electrical devices including cutouts, switches, sockets, circuit breakers and meter testing devices. He was a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers.

•

### Frederick D. Potter

Frederick D. Potter, retired electrical engineer and an associate of the late Thomas A. Edison in the development of electric lighting facilities in New York City, died on November 17 at his home in Linden, N. J. He was 88 years old.

A native of Bath, Me., and a graduate of the University of Maine, Mr. Potter began work in 1882 for the Edison Isolated Lighting Co. of New York, in charge of installing light and power units in hotels, theaters, factories and public buildings which generated their own energy. In 1913 he helped organize the Combustion Controls Co., serving as vice-president and engineer, the connection he maintained until he retired in 1930. In recent years he engaged in private research, chiefly in

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FOR HEAVY INDUSTRIAL SERVICE
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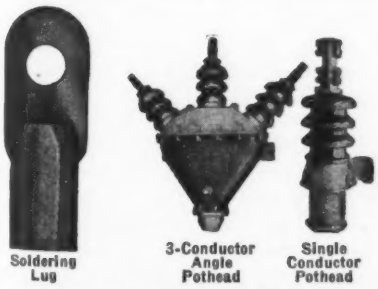


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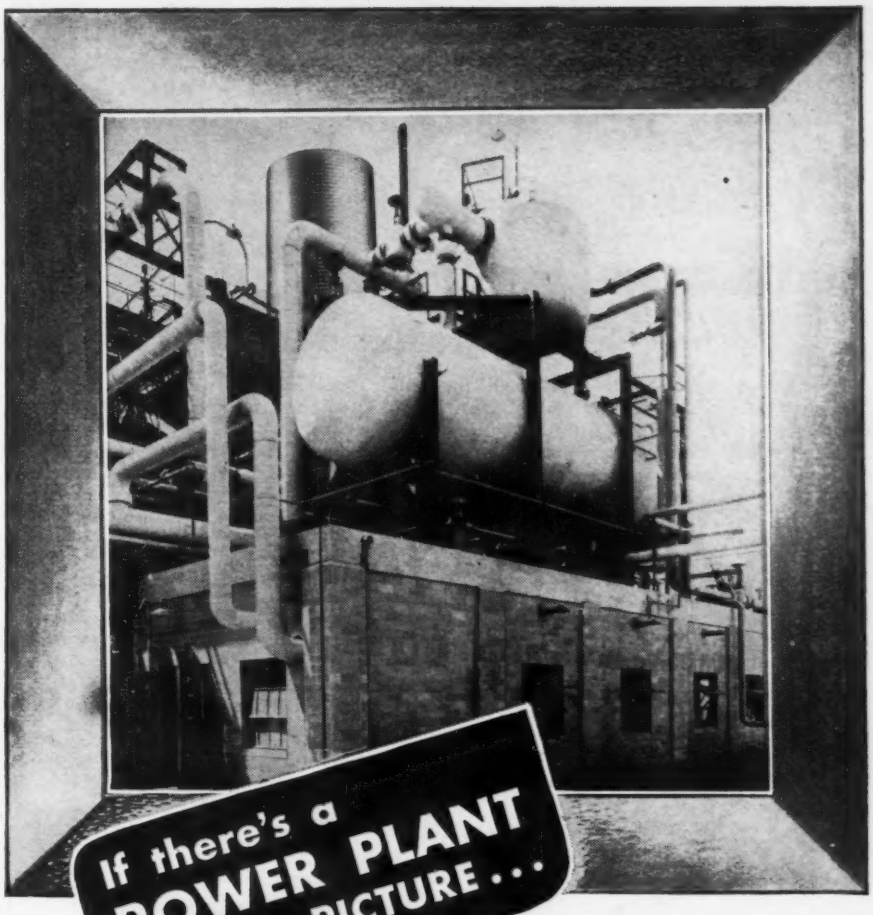


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# For PROPER PRESERVATION of POLES-CROSS ARMS

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**PENTACHLOROPHENOL**

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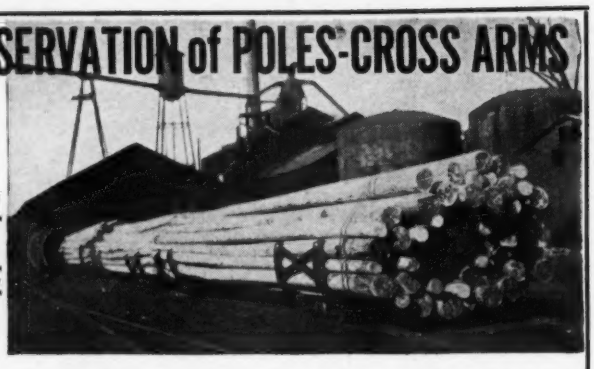
**COPPER-NAPHTHENATE**

***Oil soluble, stable resistant to leaching***



**Pentachlorophenol has outstanding wood preservative qualities. It is highly toxic to wood-rotting fungi; it is toxic to termites and wood boring insects. It is stable to light, to normal temperatures and to soil acids and alkalies. It is only slightly soluble in water and formulated with petroleum carriers is highly resistant to leaching. Leaves treated wood clean to handle. Write for booklet giving full information on how to specify Santophen 20 (Monsanto's pentachlorophenol, technical) with petroleum for pressure treatment of poles, etc.**

**Copper naphthenate is an oil soluble chemical compound with superior fungicidal properties. It is an excellent wood preservative, controlling fungi, termites and wood borers—having become available in large quantities during the war for standard treatment of sand bags and other textiles. Very stable in wood, insoluble in water, does not attack or corrode metal, and is regarded as non-hazardous to humans. Blends well with creosote-petroleum mixtures and fortifies their toxicity. Write for technical bulletin on use and application of copper naphthenate-petroleum solutions for pressure treatment of wood.**

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**ELECTRITE**

A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

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An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

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A heavy duty stud connector for connecting a tubular bus, cable or solid rod conductor to a threaded or plain transformer stud.

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***all the U. S. Saving Bonds you can***

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connection with his own inventions.

Mr. Potter was one of the last two surviving members of the Edison Pioneers founded in 1918 by associates of the late Thomas A. Edison.

•

## Robert E. Healy

Robert E. Healy, a member of the Securities and Exchange Commission and the only remaining commissioner of the original five-man commission appointed by the late President Roosevelt, died on November 17 after a long illness at his home in Germantown, Pa. He was 63 years old.

Born in Bennington, Vt., Mr. Healy was one of Vermont's widely known attorneys, when he left a successful law practice to go to Washington in 1928 to become chief counsel of the Federal Trade Commission. From 1928-1934 in his capacity as chief counsel for the FTC, he had an active part in the administration of the Federal Trade Commission Act, the Clayton Act, the Webb Pomerene Act and the Securities Act of 1933, the year in which it was administered by the FTC.

Appointed to the Securities and Exchange Commission in 1934, he was reappointed three times. As a member of the SEC, he served on the National Power Policy Committee, and as chairman of a subcommittee which proposed a bill to regulate holding companies. While on the commission, Mr. Healy was mainly concerned with enforcement of the resulting Public Utility Holding Company Act though he also appeared before many Congressional committees on matters concerning other acts administered by SEC.

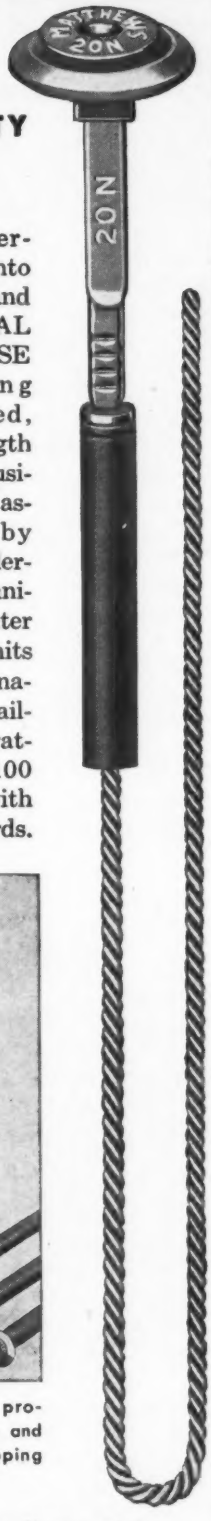
Judge Healy was a member of the executive committee of the National Association of Railroad and Utilities Commissioners, a former chairman of the Public Utility Law Section of the American Bar Association and the author of various magazine articles dealing with economics and finance.

•

► J. Archer Turner, chairman of the board of directors of the Turner Construction Co. and its president from 1941 until October 1, this year, died on November 1 in the Long Island College Hospital, Brooklyn, after a short illness. Mr. Turner was born in Betterton, Md., in 1885. During all his business life he was identified with engineering and construction work. Mr. Turner served as president of the company during the war period.

► Leon M. Gilmore, assistant to the president of the Texas Power & Light Co., Dallas, died on October 26 at the age of 48. Mr. Gilmore had been connected with Texas Power since 1924.

# UNIVERSAL MATTHEWS FUSE LINKS

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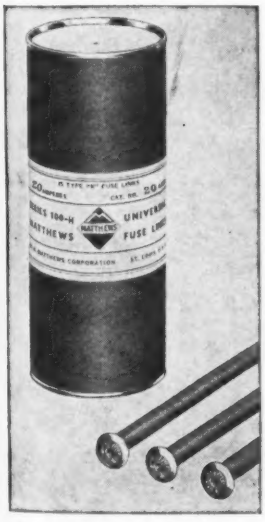
- **STRENGTH**

• These characteristics are designed into the SERIES 50H and 100H UNIVERSAL MATTHEWS FUSE LINKS by using closely calibrated, high tensile strength materials for the fusible elements and assembling parts by crimping (not soldering) which assures uniform accuracy, greater strength and permits closer fuse coordination accuracy. Available in standard ratings from 1 to 100 amperes. Comply with all NEMA standards.



Individual Fuse Link protected by paper tube and packed 25 in telescoping container.

*Write for Bulletin 533*

**W. N. MATTHEWS CORP.**
3722 FOREST PARK BLVD.
ST. LOUIS 8, MO.

# SENSATIONAL IMPROVED C-O-TWO SQUEEZ-GRIP EXTINGUISHER

## NEW 2½ and 5 lb. NOW REPLACES 2 and 4 lb. sizes

***More Fire Fighting Reserve***

***Less Weight***

***No Extra Cost***

New and larger portables with the original Squeez-Grip valve — the Navy Standard — that made C-O-Two world famous in the fire fighting field. These new portables have more punch, weigh less and have a longer effective discharge. The completely insulated swivel tube and discharge horn is an integral part of the Squeez-Grip valve. Easy to operate — one hand control — squeeze to open, release grip to close. C-O-Two kills flammable liquid and electrical fires in seconds with clean, dry, non-damaging, non-freezing and non-deteriorating carbon dioxide gas. C-O-Two will not harm machinery, equipment, material, fabrics, finishes or food. No after-fire-mess to clean up. C-O-Two is modern fire protection. Now you get additional C-O-Two protection at no extra cost.

C-O-Two is our registered trade mark and corporate name. Be safe, specify C-O-Two when ordering.

C-O-TWO

## C-O-TWO FIRE EQUIPMENT COMPANY

**NEWARK 1 • NEW JERSEY**

**Sales and Service in the Principal Cities of United States and Canada**

*AFFILIATED WITH PYRENE MANUFACTURING COMPANY*

# Industry's First 20-Million-Volt Betatron Shown by Army at Picatinny Arsenal

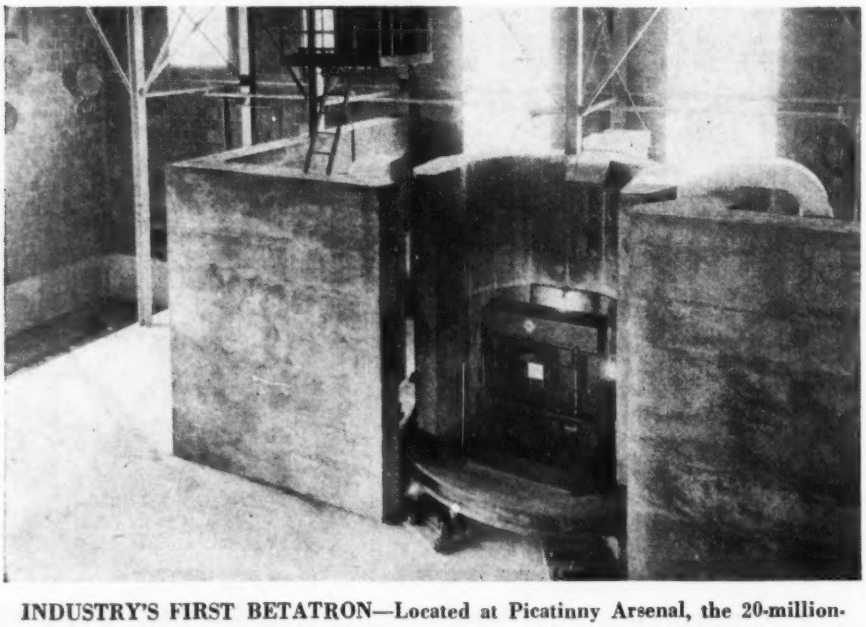
The first demonstration of the 20,000,000-volt betatron at Picatinny Arsenal at Dover, N. J., was witnessed November 14 by approximately 60 editors of the technical and professional journals and of the daily newspapers. The unit, industry's first 20-million-volt x-ray, was manufactured by Allis-Chalmers Mfg. Co. and is used to inspect shells by x-ray on a production line basis. Col. W. E. Larned, commanding officer, acted as host; D. T. Scag, University of Illinois physics department and consultant on betatron design for Allis-Chalmers, conducted the demonstration, and D. W. Kerst, professor of physics and inventor of the betatron; J. T. Wilson, chief physicist of Allis-Chalmers; and G. M. Almy, also from the University of Illinois, led the discussion.

The 20-million-volt betatron installed at the arsenal has three main components. In the transformer room a frequency tripling transformer supplies 25 kw. at 5,000 volts, 180 cycles. This is fed into the power rack which contains the operating controls and 2,000 kva. of capacitors which tune the betatron magnet to 180 cycles. A trench connects the power rack and the magnet and contains the 13,500-volt main power lines and the multiconductor control cable.

Both the magnet and power rack are completely enclosed and forced-air cooled to protect personnel from electrical hazards and to keep the unit dust tight so as to be explosion proof. The magnet cubicle is surrounded by a 15-ft. rotating ring. Shells of any dimensions up to 10 in. may be loaded at the rear, and as many as sixty 10-in. shells may be inspected in an hour. For bulky objects a 25-ton crane is provided.

All doors exposed to the main x-ray room have red warning lights which flash when the betatron is in operation. As an added precaution, all of these doors are electrically interlocked with the main betatron power switch. The unit yields 100 r (Roentgen units) at 3 ft. At this intensity the protection necessary for the operating personnel consists of 20 in. of concrete completely encircling the magnet and the x-ray room, with the exception of the way in the direct path of the x-ray beam. Here, at a distance of 40 ft. from the betatron, a 5-ft. concrete wall is provided. This protection was stated to give a maximum dosage of less than one-tenth r per 8-hr. day, which is within the requirement of the Safety Code for Industrial X-rays as published by A.S.A.

In using the equipment, the specimen to be radiographed is placed in the direct x-ray beam by sighting through the center of the aluminum exposure control box in front of the magnet. The cassette with 0.040-in. lead screen can be placed immediately behind the specimen for "contact" pictures, or many feet behind the specimen for directly enlarged pictures. Flaws or assembly clearances as narrow as two-thousands of an inch are detectable by this direct enlargement procedure.



**INDUSTRY'S FIRST BETATRON—Located at Picatinny Arsenal, the 20-million-volt x-ray unit, dwarfed by the massive concrete walls, is now ready to "inspect" shells either on the ring or on the 25-ton crane hook**

### *Three Steps in Operation*

Operation of this 20,000,000-volt x-ray generator has been reduced to three steps. First the auxiliary circuit switch is closed to warm up the filaments. This is accomplished in about five minutes. When the green "ready to operate" light flashes, the magnet is energized by pushbutton control and injection voltage is slowly increased until full yield is obtained. From here on, with the exposure control preset, the betatron takes over.

The unit is designed for continuous 8-hr. duty without resultant hardship on the components. It was stated that the only maintenance that may be required will be replacement of the control tubes, the doughnut, and a few pieces of fish paper after several hundred hours of operation. Since the magnet yoke contains about 3 tons of iron, replacement of the doughnut has been simplified by the use of motor driven screw jacks which are an integral part of the magnet yoke.

On Friday, the day following the editors' visit, 60 leading physicians attended a preview of the unit's application in the fields of medicine and biological research, and on Monday, more than 100 representatives of indus-

try witnessed its application to various manufacturing procedures and methods.

•

## Price Rises Expected Following OPA Death

Price rises in heavy apparatus lines are predicted by most manufacturers but only following an item-by-item cost review. OPA has been "dead" too short a time for the percentage write-up to be made known but "the talk" is not "is it coming," but "how much will it be."

Many of the major appliance manufacturers have already announced price increases for ranges, refrigerators, washers, home-freezer units, etc.

Some heavy equipment has already "gone up." Westinghouse has announced an increase of 8 percent on distribution transformers, 20 percent on low-voltage switchgear, 25 percent on fractional horsepower motors and 13 percent on integral horsepower motors.

The industry is expected to make increases on other items. These will be limited to those pieces of apparatus which have been produced either at a loss or not earning a fair profit ratio. Manufacturers this week were busy studying production costs in the light of new material costs.

Copper, lead and tin either have risen or are expected to rise very shortly. The trade expects the new copper price to settle at about 17½ cents, an increase of 3¼ cents over the previous domestic price of 14⅜ cents after Kennecott Copper, Phelps Dodge and American Smelting & Refining announced that increase.

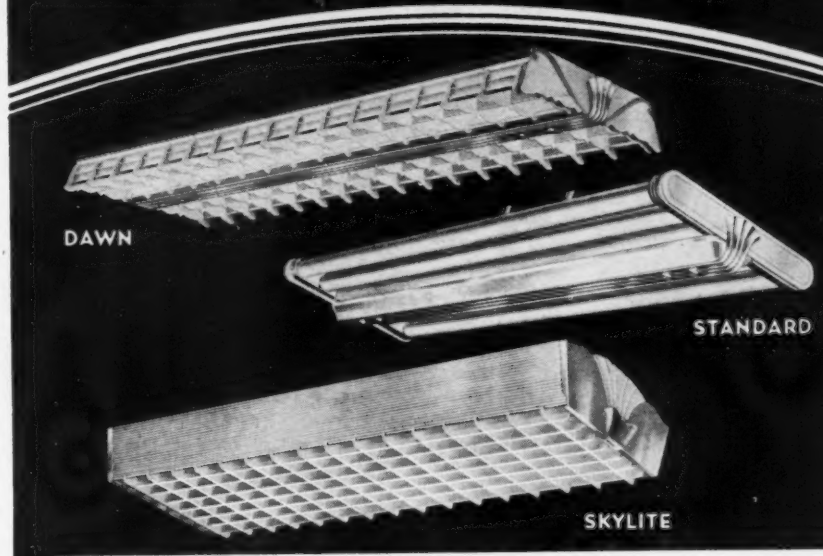
St. Joseph Lead announced an advance of 2¼ cents for lead to a new price of 10½ cents, New York, and 10.35 cents, St. Louis. Grade "A" tin rose 18 cents to 70 cents per pound and zinc advanced 2¼ cents to 10½.

Along with the advance in copper prices, Copperweld Steel announced an immediate increase of about 6 percent in the price of copper-clad wire. Anaconda announced that the local base price on bare copper wire has been advanced to 23.82 cents per pound from 20.39 cents and on weatherproof wire to 25.32 cents from 22.57.

Comments on the effect of decontrol on appliances were similar to that given by J. H. Ashbough, vice-president, Westinghouse Electric Corp.:

"The immediate effect of removing price controls on home appliances will be a leveling one. Some will naturally have to increase; others will not change. As greater production is achieved and as we get closer to prewar efficiency, the prices will, barring further cost increases, be reduced."


Smithcraft . . . THE FLUORESCENT
with *custom-made* quality and appearance




A Complete Line of Industrial and Commercial Fluorescents
*Distributed exclusively through electrical wholesalers*

Smithcraft LIGHTING DIVISION
Chelsea 50, Mass.

TRIPLE FUSE SERVICE
with this
TRICO
REG. U. S. PAT. OFF.
COMBINATION!

KLIPLOK CLAMPS
Supply needed pressure for easy flow of current!

- Increase fuse life.
- Prevent burnt fuses and clips.
- Stop unnecessary shutdowns.
- Save power.
- Reduce fire and accident hazards.

TRICO "Powder-Packed" RENEWABLE FUSE

This " different " fuse gives maximum protection and THREE TIMES the SERVICE at no added cost. Custom-built renewal element, " powder-packed " feature, and rugged construction make possible the following advantages . . .

- Tamperproof protection.
- Non-interchangeable link.
- Safe time-lag.
- Link support.
- Life-time outer parts.
- Guaranteed results.

TRY *this* COMBINATION TODAY!
WRITE for Bulletin #1 and 6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

# RADIO TUBE MANUFACTURING PLANT

GOVERNMENT OWNED
SURPLUS PLANTS

# FOR SALE OR LEASE

## NORTH OF FAIRMONT, WEST VIRGINIA

★ This plant, Plancor 314, was constructed for the manufacturing of radio transmitting tubes, transmitting equipment and related electronic devices and was operated during the war by the Westinghouse Electric & Manufacturing Co.

**LOCATION:**

Approx. 20 acres, of which there are about 9 acres vacant which could be utilized for expansion, located in Hoult Township, north of Fairmont, West Virginia.

**BUILDINGS:**

TUBE PLANT, 1-story with mezzanine, 243′ x 360′. The factory contains approx. 86,500 sq. ft. and the mezzanine approx. 16,400 sq. ft. Smaller buildings and structures totaling about 5,000 sq. ft. of floor space are: HYDROGEN and NITROGEN STORAGE, ALCOHOL and ACID STORAGE and OXYGEN HOUSE. There is also a COOLING TOWER with a capacity of 100,000 gallons.

**CONSTRUCTION:**

Generally wood columns, trusses, purlins, and roof deck covered with composition roofing. Exterior walls of tile and wood sash.

**EQUIPMENT:**

Standard and special production equipment including: annealing ovens, glass lathes, flare machines, sealing machines, beading machines, degreasers, vacuum carbonizing equipment, etc. Miscellaneous metal forming and sheet metal tools and machines, laboratory and testing equipment, furniture and fixtures.

**UTILITIES:**

Furnished complete by local companies.

**TRANSPORTATION:**

Siding of the Baltimore and Ohio Railroad on site. Plant fronts on State Road which leads to arterial highways.

**CREDIT TERMS:**

Credit terms for the purchase of this property may be arranged. If you can qualify as a small business firm, you may make application for a priority for purchase through the Reconstruction Finance Corporation, which priority is second only to Federal agencies.

Reference to these facilities by name of lessee is for identification purposes only and has no connection with the lessee's plants or facilities. Information contained in this advertisement is not intended as a basis for negotiation. War Assets Administration reserves the right to reject any or all proposals.

Sealed proposals are invited. Specifications for the content of these proposals may be obtained from any War Assets Administration Office. Address all specific inquiries and proposals to:

# WAR ASSETS ADMINISTRATION

**OFFICE OF REAL PROPERTY DISPOSAL**
**EAST END FOURTH STREET, RICHMOND, VA.**

870

## Recent Rate Changes

CENTRAL LOUISIANA ELECTRIC CO., Alexandria, La., has made a rate reduction, which means an annual saving of approximately $14,000 to its consumers. The state Public Service Commission has approved the reduction.

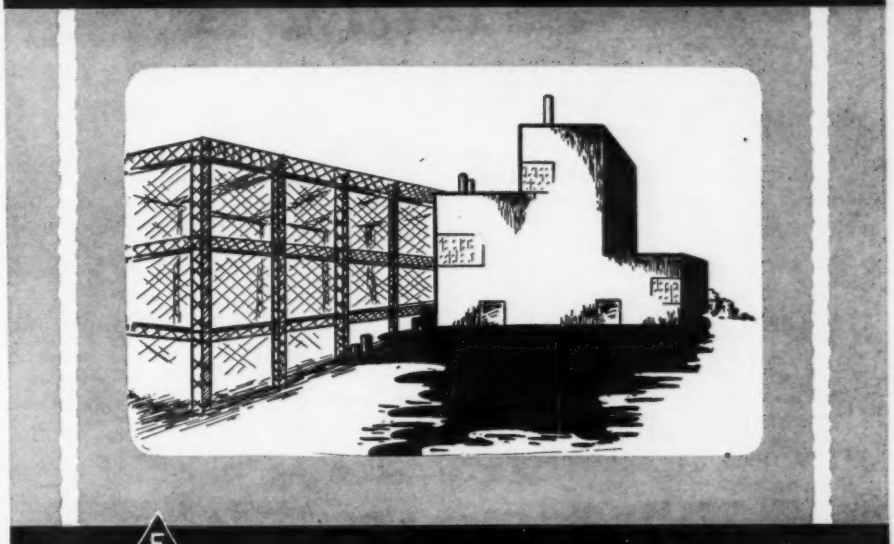
DETROIT EDISON CO. has been granted permission by the Michigan Public Service Commission to slash its rates by approximately $2,500,000, as a result of two orders signed by the commission. The first order will give to commercial, farm and residential customers a 15 percent rebate on their November and December bills, amounting to about $1,500,000. The second order slashes industrial rates by 3 percent, or approximately $927,000, starting January 1, 1947. Detroit Edison reduced its rates voluntarily in compliance with a verbal agreement reached last January when a $3,000,000 rate reduction order became effective. A decision on a third utility suggestion to transfer $5,804,500 from a reserve post-war adjustment fund to an employees' retirement pension fund, was postponed until November 26 at the request of the City of Detroit.

NEW WESTMINSTER (BRITISH COLUMBIA) ELECTRIC LIGHT DEPARTMENT has reduced its electric light rates, effective November 1. The rates are divided between homes with no electric range and those using an electric range. For the former the new rates are: six cents for the first 30 kw.-hr.; two cents for the next 200 and one-and-a-half cents for all over this amount. The old rates were respectively, eight, three and one-and-a-half cents. For electric range users the new rates are: four cents for the first 30 kw.-hr.; two cents for the next 200; one cent for the next 1,000 and then an increase beyond this consumption to one-and-a-half cents. The old rates were respectively: four cents for 30 kw.-hr.; three cents for the next 200 and one-and-a-half cents above this amount.

CLARK COUNTY, WASH., Public Utilities District commissioners have approved a reduction in residential and commercial rates, which will bring a saving of $16,500 a year to consumers. The reduction brings this year's savings to $56,500. Two residential schedules were combined. The rate in the higher bracket was reduced and the $4.50 minimum charge on the all-electric home rate was abolished. The new residential rate has a minimum charge of 85 cents a month. In commercial rate revisions, two schedules were combined for a 5 percent reduction, and four other commercial schedules were combined into one rate to effect savings of 2½ percent.

OKANOGAN, WASH., COUNTY P.U.D. No. 1 has announced a rate reduction effecting a $9,100 saving for its customers. Under the rate change, rural and suburban homes and farms and commercial accounts will be billed under the same rates available to these classes of customers located within corporate limits of cities and towns. The rate reduction is the fourth step in the district's program of simplification of electric rates within the county. In 1945, the district eliminated the higher of two irrigation pumping rates; in January of this year employees' discounts were eliminated, and this spring all churches and public schools were changed over from a special higher rate to a lower commercial lighting and power rate.


WELSBACH
ENGINEERING AND MANAGEMENT CORPORATION
UTILITY APPRAISALS • ENGINEERING • CONSTRUCTION
STREET LIGHTING MAINTENANCE



E WELSBACH M
Consultants on all Phases of Utility Operations
1500 WALNUT ST., PHILA. 2, PA.

Electrical Design Engineer
UNDERGROUND LINES

Opportunity for permanent placement with a Large Utility Corporation is currently available to a Graduate Electrical Engineer able to qualify as follows:

Thorough knowledge of modern power cable work, including high voltage transmission cable. Considerable practical experience in cable engineering and operating all voltages. Experienced in the preparation of designs, estimates, reports, etc. Take charge of cable engineering staff.

State details in full concerning above: age and approximate salary desired, date available and address all replies to

EMPLOYMENT SUPERVISOR
B. C. ELECTRIC RLY. CO. LTD.
VANCOUVER, B. C.

KEES
Outdoor Meter Boxes
A size for every need.

Galvanized steel, baked aluminum finish. Designed for economical installation.

Write for catalog
F. D. Kees Mfg. Co.
Box 646
Beatrice, Nebr.

PLASTIC-COVERED WIRE WANTED
BY ESTABLISHED EXPORTING & IMPORTING FIRM

Well-known exporting and importing organization with excellent outlets in the Orient, and with orders on hand; desires to contact manufacturer of plastic covered copper lamp cord and plastic covered copper wire No. 18 solid type T.

Reply to
RA-396, Electrical World
68 Post Street, San Francisco 4, Calif.

SUBALOX
LEAD AND ALUMINUM PAINT
Spot or Full Coat
for
Galvanized Structures.
It sticks, it blends.
SUBOX INC.
NORTH ARLINGTON, N. J.

# PROFESSIONAL SERVICES

## Associated Engineers, Inc.

*Joseph C. Lewis, President*

Management Consultants
Engineering . . Architecture - - Accounting
Organization - - Methods - - Costs.

230 E. Berry St., Fort Wayne 2, Ind.

## ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

## CHAS. T. MAIN, INC.

*Engineers*

Boston, Mass.

Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

## BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## FORD, BACON & DAVIS

ENGINEERS

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Philadelphia • Chicago • Los Angeles

## J. H. MANNING & COMPANY

ENGINEERING
SERVICES

120 Broadway, New York

## BLACK & VEATCH

*Consulting Engineers*

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

## PAUL E. GERST & CO.

CONSULTING ENGINEERS

Specialists in
Electrical Product Design
El. Machinery, Apparatus & Applications
El. Appliances, Hi-Frequency Apparatus
Electronics, Radio Communications.

205 W. Wacker Dr. Chicago 6, Ill.

## DANIEL W. MEAD
## F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

## E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Economic and Business Surveys
Valuations and Reports
Rate and Rate Case Analyses

61 Broadway New York

## GILBERT ASSOCIATES, Inc.

*Engineers and Consultants*

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES

Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway New York
Reading Pa.
17 & Sansom Phila., Pa.
1417 K St. N.W. Washington, D. C.

## ARTHUR L. MULLERGREN

*Engineering-Management*

*Public Utilities—Natural Gas*

Kansas City, Mo.

## HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

350 Fifth Avenue New York 1, N. Y.

## RAYBURN M. HAMILTON

*Professional Engineer*

711 Scanlon Bldg. Houston, Texas

## PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION

Consulting Engineers

Design Operations

Steam—Hydraulic—Gas

231 S. La Salle St. Chicago 4, Ill.

## DAY & ZIMMERMANN, Inc.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

## FREDERIC R. HARRIS, INC.

ENGINEERS CONSTRUCTORS

MANAGEMENT
NEW YORK

Knoxville Houston San Francisco

## Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
*Bill Frequency Analyzer*

102 Maiden Lane New York

## DOBLE ENGINEERING COMPANY

*Electrical Insulation Engineers*

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.

Office and Laboratory: Medford Hillside, Boston, Mass.

Branch Office: 20 N. Wacker Dr. Chicago, Ill.

## HENKELS & McCOY

*(Electric & Telephone Line Construction Co.)*

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

## SANDERSON & PORTER

ENGINEERS

*AND*

CONSTRUCTORS

## Ebasco Services Incorporated

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

## HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

## SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

## ELECTRICAL TESTING LABORATORIES INC.

Specializing in

TECHNICAL SERVICES

to those intent upon good quality

2 East End Avenue at 79th St., New York 21, N.Y.

## WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
*Engineers—Economists*
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
Noroton, Connecticut

## THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

## H. F. FERGUSON

*Consulting Electrical Engineer*

Expert advice on location and purchase of right of way.

Industrial plant layouts & surveys. Rate comparisons.

388 Alameda Avenue Youngstown, Ohio

## LUCAS & LUICK

ENGINEERS

DESIGN, CONSTRUCTION SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

## WHITMAN, REQUARDT AND ASSOCIATES

ENGINEERS — CONSULTANTS

Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plans—Supervision—Appraisals

1304 St. Paul Street Baltimore 2, Md.

## Manufacturers Make Sales Assignments

Electrical manufacturing companies have made the following appointments to their sales staffs:

G & W Electric Specialty Co., Chicago, has appointed Robert B. Smith representative in northern Florida with headquarters at 304 Roberts Bldg., Jacksonville. Mr. Smith was formerly with Westinghouse Electric Supply Co. LeRoy Allen, who has joined Shaw Hardy Co., 942 Ingraham Bldg., Miami, Fla., will represent the company in southern Florida.

Buckingham Manufacturing Co., Inc., Binghamton, N. Y., has appointed E. R. Tree midwestern district sales manager. Prior to joining Buckingham, he was with the Davis Emergency Equipment Signal Corp. and with the American Society of Mechanical Engineers. Lewis Electrical Co., 560 North 16th St., Philadelphia, Pa., has been appointed sales representative with operations in eastern Pennsylvania, southern New Jersey, Delaware and Maryland. J. J. Costello Co., 131 Clarendon St., Boston, Mass., has been appointed Buckingham representative in the New England territory.

Standard Transformer Co., Warren, Ohio, has appointed the Southwest Sales and Service Co., Shreveport, La., as its representative for the states of Louisiana, Mississippi and Arkansas. Southwest Sales and Service Co. succeeds the late C. R. Churchill as Standard representative for Louisiana and Mississippi.

The Edwin F. Guth Co. of St. Louis has appointed Charles C. Munroe, Jr., as their direct representative in the Michigan territory, and the Toledo, Ohio, area. Mr. Munroe has been active in the lighting field for the past 16 years. He returned to the States after some two years on the Ford Motor Co. rubber plantation in Brazil to study lighting at the Westinghouse Lamp Co., after which he served in the Westinghouse offices in New York and Detroit. He then became identified with two wholesale supply houses in Detroit, the Electrical Specialties Co. and the Fife Electrical Supply Co. During the war years, Mr. Munroe did all the electrical buying on the Ford River Rouge plant expansion job and later on the Willow Run bomber plant.

•

## Lighting Gain 30%

Correction—In reporting the improvement in general illumination after repainting at the famous windowless plant of Simonds Saw and Steel Co. of Fitchburg, Mass., (Electrical World, October 12, 1946, page 99) we erroneously gave the figure of 25 percent as the average gain in lighting intensity after walls, ceiling and upper structure were repainted white with "Barreled Sunlight." A check of the before-and-after light meter readings shows that the average gain in the 72 bays was not 25 percent but 30 percent.


# FOR SALE OR LEASE

GOVERNMENT OWNED
SURPLUS PLANTS

# Radio Transmitting Tube MANUFACTURING PLANT

**IN SALT LAKE CITY, UTAH**

★ This plant, Plancor 636, was constructed in 1942 for the manufacture of radio transmitting tubes, transmitting equipment and related electronic devices. It was operated during the war under the management of Eitel-McCullough, Inc.

**LOCATION:**
Approx. 10 acres located at 525 West 13th South Street in Salt Lake City, Utah.

**BUILDINGS:**
MAIN BUILDING has 2 stories, is 200′ x 260′ and contains approx. 104,000 sq. ft. Ceiling heights—1st floor, 9′ and 2nd floor, 10′. Other smaller structures include: GUARD-HOUSE, OXYGEN HOUSE, HYDROGEN HOUSE and BARREL HOUSE.

**CONSTRUCTION:**
Main building has concrete foundations, light structural steel and wood framing. Three walls and roof are corrugated, galvanized iron, the front wall is stucco. Concrete and wood flooring. The smaller buildings are generally wood frame with concrete floors.

**EQUIPMENT:**
Standard and special production machinery and equipment including; annealing ovens, cutters, presses, arc and spot welders, drills, glass lathes, grinders, etc. Also items of laboratory and testing equipment, furniture and fixtures.

**UTILITIES:**
Furnished complete by local companies.

**TRANSPORTATION:**
City streets connect with arterial highways. Salt Lake City Airport about 10 miles away.

Credit terms for the purchase of this property may be arranged. If you can qualify as a small business firm you may make application for a priority for purchase through the Reconstruction Finance Corporation, which priority is second only to federal agencies.

Reference to these facilities by name of lessee is for identification purposes only and has no connection with the lessee's plants or facilities. Information contained in this advertisement is not intended as a basis for negotiation. War Assets Administration reserves the right to reject any or all proposals.

Sealed proposals are invited. Specifications for the content of these proposals may be obtained from any War Assets Administration Office. Address all specific inquiries and proposals to:

# WAR ASSETS ADMINISTRATION

**OFFICE OF REAL PROPERTY DISPOSAL**

**BUILDING 440, FORT DOUGLAS, UTAH**

869

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE:**

*(Not available for equipment advertising)*

15 cents a word, minimum charge $3.00. (See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.

PROPOSALS, 75 cents a line an insertion.

**INFORMATION:**

BOX NUMBERS care publication New York, Chicago or San Francisco offices count as 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

**DISPLAYED RATE:**

The advertising rate is $8.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.W.

*NEW ADVERTISEMENTS received by 10 A. M., November 29th, will appear in the December 7th issue subject to limitations of space available.*

WANTED

**ELECTRICAL ENGINEER**

**GRADUATE E. E.**

to act as

**Assistant to Chief Engineer**

in large electric generating plant located in the EAST

*Should have*

**4 to 8 YEARS EXPERIENCE**

*in steam power plants.*

**POSSIBILITIES FOR ADVANCEMENT**

Reply by letter stating full qualifications and experience

P-386, Electrical World
330 West 42nd St., New York 18, N. Y.

**ELECTRICAL ENGINEER**

**SEEKS NEW POSITION**

Electrical Engineer, graduate of M.I.T., 1912, desires new connection. In present position over 25 years, finally as Manager, and Engineer Public Utility. Experienced in design construction, operation and management of large power plants, Hydro and Transmission Distribution Systems. Perfect health, excellent references and will go anywhere. Write to—

PW-400, Electrical World
330 West 42nd St., New York 18, N. Y.

### POSITION VACANT

POWER SALES Engineer not over 35 years of age with 5 to 10 years experience on Industrial Accounts. Must be thoroughly familiar with power and heating applications—especially with modern developments. Supply details on experience and employment record in application. Our personnel know of this ad. P-401, Electrical World, 330 W. 42nd St., New York 18, N. Y.

(Additional Positions Vacant ads on page 143)

### EMPLOYMENT SERVICES

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PW-398, Electrical World
330 West 42nd St., New York 18, N. Y.

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ELECTRICAL ENGINEER, B.E.E., age 41, twenty years experience in operating department desires position as Meter or Substation Superintendent. PW-366, Electrical World, 330 W. 42nd St., New York 18, N. Y.

CONSTRUCTION ENGINEER and Superintendent 25 years broad experience in construction of electric power plants, transmission and distribution systems and diversified utility construction. Especially qualified in job control and work progress activities. Available immediately. PW-407, Electrical World, 68 Post Street, San Francisco 4, Cal.

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ELECTRICAL ENGINEER, BSEE, 39, wants position demanding intimate knowledge of Electric System Planning, Relaying and Operation. PW-389, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER with consistent record of advancement in power engineering field during past twenty years wishes to exchange correspondence with executive who may have a responsible position open in the near future. PW-391, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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(Additional Employment Advertising on page 143)